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CONTENTS

EDITORIAL:

Editorial Notes 655
Cost of Yard Operation..... 655
Evidences of Business Improvement 655

PROCEEDINGS:

American Railway Engineering Association..... 657

MISCELLANEOUS:

Announcements 656
Registration American Railway Engineering Association..... 672
Resolutions 672

Cost Of Yard Operation

The Committee on Yards and Terminals presented a comparison of the costs of operation of one hump and two flat yards which is highly interesting. From this comparison it would seem that the cost of operating a flat yard is considerably below that of a hump yard. This has been a disputed point for many years, and although numerous attempts have been made to collect data of this nature, direct comparisons have been difficult if not impossible to make because of the widely varying bases upon which data have been compiled. This deduction of the relative cost of operating the two types of yards must be considered as only tentative, as the committee submitted the data only as information, not having sufficient statistics, and the investigation covering too small a number of yards to enable any definite conclusions to be drawn. One point emphasized by the chairman which deserves special emphasis is that the cost per cut of cars should be computed as well as the cost per car, for the latter figure depends directly upon the former.

Reduction In Engineering Forces

There has been a great deal of informal discussion outside of the convention hall regarding the very general reduction in engineering forces during the past year, and the effects of this form of retrenchment on the organization of this department as well as on future maintenance expenditures. The chief engineer of one road reports that his monthly pay roll of $40,000 one year ago has been reduced to $15,000, and his forces were formerly on a purely maintenance basis. The engineering organizations on many roads are now considerably below the 1907 basis. Every engineering officer feels strongly that such radical reductions in forces remove much needed supervision which cannot fail to be reflected in increased expenditures in other ways. Also, an organization once destroyed is exceedingly difficult to rebuild or replace. We do not believe that executive officers are unaware of this condition or that they are requiring such reductions without serious consideration of the results. With the continually increasing cost of operation and the severe slump in business and unaccompanied by sufficient increases in rates the problem is an exceedingly complicated and serious one. But we do believe that in some cases the line of present as well as ultimate economy, viewed from this standpoint, has been crossed.

Adopting Recommended Practices

At each recent convention there has been an undercurrent of opinion that the present method of adopting recommended practices is faulty in that standards of much importance are adopted by the vote of a very small proportion of the membership. Furthermore, many of those voting have not previously given the subject careful consideration. For instance, the proposed clearance diagram was rejected by the narrow margin of five votes, with less than 100 members voting. In spite of the fact that the American Railway Engineering Association bears no official relation to the railways, its recommendations carry much weight and are taken to represent approved practices, as should properly be the case. While the higher officers realize more directly their responsibilities in many of these matters, they are out-voted frequently by others whose positions do not entail such responsibilities and who, therefore, view these subjects from a somewhat different angle. One member's vote should, of course, have equal weight with that of any other member. The problem is to present the recommendations before the entire membership in such a manner that the decisions may represent the desires of the entire membership. It is questionable if a letter ballot will secure such a result any more closely than the present system, for while it will require the individual attention of the members, those not in attendance at the convention do not have the opportunity to hear the arguments on both sides unless they are presented in a statement accompanying the ballot. Such a procedure also delays action and involves a vast amount of clerical work. This problem is one of importance for the association.

Evidences of Business Improvement

The view has been expressed on all hands by railway men and railway supply men attending the conventions in Chicago that while business is improving much more slowly than could be wished, there are numerous evidences that it is getting better and that it will continue to do so. This view is given emphatic support by a statement made by President Fahey of the Chamber of Commerce of the United States, which was published in the newspapers yesterday morning. Mr. Fahey was in Washington attending a meeting of the board of directors of the Chamber of Commerce, and expressed the consensus of opinion of the directors, who come from all parts of the United States. "The resumption of business activity is con-

tinuing steadily," said Mr. Fahey, "and the movement should quicken now. The consensus of all expressions is that in almost all directions things are mending rapidly. As a result of the war it is inevitable that there be slowness in some lines, but more men are being put to work every week, and the industrial output is increasing." These assurances, coming from the highest authority in the commercial world, are highly encouraging. Whatever increases business activity in general increases railway traffic and earnings; and whatever increases them stimulates railway purchases and helps the railway supply business. It is a long lane of bad business that the railways and railway supply concerns have been traveling; but it's a long lane that has no turning, and the worst part of the difficult period of readjustment caused by the war appears to be behind us.

AN ACROSTIC ON THE ASSOCIATION

Ability
Reliability
Endurance
Action

A. S. T. M. COMMITTEE MEETING

Committee D-7 of the American Society for Testing Materials will hold a meeting at 9:30 this morinng in the French room of the Blackstone Hotel.

PHILADELPHIA ELECTRIFICATION IN SERVICE

The Pennsylvania placed in service yesterday the first section of the electrified suburban lines between Philadelphia and Paoli, 20 miles.

THE GRADING OF LUMBER COMMITTEE MEETING

Chairman von Schrenk of the special committee on Grading of Lumber has called a meeting of that committee for 9:30 this morning at the Blackstone hotel.

CHANGES ON KANSAS CITY TERMINAL RAILWAY

E. P. Weatherly, engineer maintenance of way; A. H. Stone, assistant engineer, and J. Tuthill, engineer of buildings, of the Kansas City Terminal Railway, have resigned and those positions have been abolished.

C. E. LINDSAY A DIRECTOR

C. E. Lindsay, division engineer of the New York Central at Albany, N. Y., was elected a director of the American Railway Engineering Association at the meeting of the board after the close of the convention yesterday, to fill the vacancy created by the election of J. G. Sullivan to the second vice-presidency.

CANADIAN NORTHERN HALF-INTERLOCKING PLANT

The Canadian Northern has asked for bids on a half-interlocking plant at the crossing of the Winnipeg Electric and the Canadian Northern, at Portage avenue, West side Winnipeg. The installation also provides protection for a bridge and a stretch of track used jointly by street cars and railway cars.

PENNSYLVANIA ENGINEERS

The Maintenance of Way Association of the Pennsylvania Lines held its semi-annual session Tuesday and Wednesday at the offices of the Pennsylvania Lines in the Insurance Exchange, considering general matters of interest to this department. About 35 division engineers and other maintenance of way officers were present. F. Watts, division engineer, Pittsburgh division, is president and D. M. Craig, assistant engineer, is secretary of this association.

ELECTRIC RAILWAY ASSOCIATION MEETING

The Illinois Electric Railway Association will hold its regular quarterly meeting at 10 a. m. to-day, at the New Morrison hotel. After the meeting the members will attend the regular association luncheon.

AMONG THE VISITORS

Morgan K. Barnum, superintendent of motive power and W. Malthaner, superintendent of shops of the Baltimore & Ohio, were visitors at the Coliseum yesterday.

J. W. Kreitter, superintendent of the Duluth, Missabe & Northern, was also a visitor at the Railway Appliance show.

OGLE COALING STATION

In the description of the coaling station of the Nashville, Chattanooga & St. Louis at Hollow Rock Junction, Tenn., for which a special design with three storage bins was prepared, published on page 603 of yesterday's Daily, the fact that this design was prepared by the Ogle Construction Company, Chicago, was unintentionally omitted.

VALUATION MEETING POSTPONED

The conference between the representatives of the railways and the division of valuation of the Interstate Commerce Commission, which was called by Director Prouty to be held in Washington on March 22 for the purpose of considering a number of questions in connection with the federal valuation, has been postponed until April 19.

SOUTHERN PINE SPECIMENS

The Forest Products Laboratory, Madison, Wis., furnished several specimen cases of Southern yellow pine which were on exhibit yesterday in the corridor of the Congress hotel adjacent to the convention hall. These specimens were examined with interest by many of the members as illustrating grades of lumber which would be accepted and rejected according to a proposed grading rule which in the essentials follows closely the rules which were used by the Isthmian Canal Commission in the purchase of lumber for the construction of the Panama Canal and were published as an appendix to the report of the committee on Grading of Lumber.

B. & O. OFFICIALS TO BEGIN DETAILED INSPECTION

A number of officials in branches of the operating department of the Baltimore & Ohio were in Chicago yesterday attending the convention and visiting the exhibit. Today they will start on a detailed inspection to determine their programme for improvements and maintenance during the coming months. The party is headed by A. W. Thompson, vice-president in charge of operation, and includes C. S. Galloway, general manager eastern lines; J. M. Davis, general manager western lines; E. A. Peck, general superintendent; F. H. Clark, general superintendent motive power; M. K. Barnum, superintendent motive power; Paul Didier, principal assistant engineer; Earl Stimson, chief engineer maintenance of way; John Spielman, engineer maintenance of way; H. R. Talcott, engineer of surveys; G. A. Small, district superintendent motive power; J. R. Kearney, general superintendent of transportation, and a number of others.

The annual luncheon of B. & O. officials attending the convention was abandoned this year because of depressed business conditions.

Proceedings of Railway Engineering Association

Abstracts of Eight Reports Including Masonry, Wood Preservation, Bridges and Trestles and Electricity

The Thursday morning session of the American Railway Engineering Association was called to order at 9:30 a. m. by President Storey in the Florentine Room of the Congress Hotel, Chicago.

WOOD PRESERVATION

Of the subjects assigned by the Board of Direction, report is submitted on the following:

(1) The use of coal tar in creosote.
(2) Water in creosote.
(3) Compilation of information from service tests and reports of inspections of sections of test track.

THE USE OF COAL TAR IN CREOSOTE.

The tendency in the wood preserving industry during the past year has been to continue and to some extent increase the practice of using refined coal tar in creosote, which was considered by the Committee on Wood Preservation in last year's report. The supplemental report on this subject, which

EARL STIMSON,
Chairman Committee on Wood Preservation.

was presented by Dr. Hermann von Schrenk last year, covered the general situation, and there are as yet no new specific data available, although it may be stated that the practice of using a solution of refined coal tar and creosote has become more permanently established.

The commercial and economic conditions make advisable the conservation of the creosote supply. One of the feasible means of augmenting the available output of domestic creosote is by the proper addition of refined coal tar. This practice has been followed for some years, and there is every indication that it will be increased in the future. It follows, therefore, that a thorough mutual understanding between the treating plants and the consumer is desirable.

The best results are obtained from a solution of refined coal tar in creosote, which is filtered after being properly mixed. The filtration process removes much of the free carbon and reduces the viscosity of the fluid, with the result that the oils are thoroughly incorporated into an entirely homogeneous product. Such a solution is superior to and will give better penetration than one unfiltered and improperly mixed, and in tests under certain conditions (see pages 1074 to 1088, Vol. 15) did not reduce the penetration as compared with straight creosote. In cases where satisfactory penetration can be obtained the use of such a solution encourages the preservation of certain timbers which would otherwise be used untreated, and makes for economy where the supply of creosote is inadequate and the cost is higher than that of the solution.

The committee last year recommended certain precautions in case a creosote-coal tar solution was used, but made no recommendations as to the advisability of the refined coal tar addition. We are still unprepared to recommend regarding the advisability, nor can comparative service results between straight creosote and that to which refined coal tar has been added, be stated. The fact remains, however, that the practice is firmly established and widely followed. Hence, the committee feels justified in making recommendations which will protect the railway companies as fully as possible against unsatisfactory material or improper mixtures.

To this end we recommend for adoption and insertion in the Manual the following specification for a creosote-coal tar solution, and would emphasize that, while it is not a specification which is strictly accurate in a technical sense, it meets all practical requirements:

"The oil shall be a pure coal-tar product, consisting only of coal-tar distillates and oils obtained by the filtration of coal tar. It shall contain no admixture of crude tar.

"Water shall not exceed 2 per cent.

"Specific gravity at 38 deg. C. shall not be less than 1.03, nor more than 1.10.

"Matter insoluble on hot extraction with benzol shall not exceed 2 per cent.

"The specific viscosity (Engler) at 82.3 deg. C. (180 deg. F.) shall be not more than 1.170 for 200 cc. No variation above this standard shall be allowed. The term, 'Specific Viscosity,' in this case shall mean the number of seconds found for the sample tested, divided by the number of seconds for water at 20 deg. C. given in the official certificate for the viscosimeter used.

"On distillation by the standard method of the American Railway Engineering Association, it shall yield the following fractions based on dry oil:

"Not more than 1 per cent at 170 deg. C.
"Not more than 5 per cent. at 210 deg. C.
"Not more than 30 per cent at 235 deg. C.
"The residue at 355 deg. C. shall not exceed 26 per cent."

The quality of the coal tar used is an important factor, and as a further protection to the consumer, the committee recommends for adoption and insertion in the Manual the following.

(1) That the refined coal tar used be subject to inspection or analysis by the railway company at any time, such examination to be permitted upon request prior to the mixing of the solution. This is for the reason that determination of the quality of the coal tar after its addition to the creosote is difficult, if not impossible.

(2) That in case the railway companies makes its own solution of coal tar and creosote, using crude tar for this purpose, it specify clearly as to the quality of the tar.

In last year's report, the committee submitted for the information of the Association six precautions to be followed in the use of coal tar in solution with the creosote. The committee desires to modify these precautions so that they will read as follows:

(1) That there be a distinct understanding between all concerned that a mixture is specified and used.

(2) That the coal tar may be added to the creosote at treating plants when suitable facilities for properly mixing the solution are available otherwise the solution should be mixed by the manufacturer, but subject to the inspection or supervision of the railway company.

(3) That under no circumstances should the coal tar added constitute more than 25 per cent of the mixture.

(4) That the coal tar and creosote be thoroughly mixed at a temperature of approximately 180 deg. F. before being applied to the timber, and that the mixing be done in tanks other than the regular working tanks, and that the tanks containing the mixture shall be heated and agitated thoroughly each time before any oil is transferred to the working tanks.

(5) That only low-carbon coal tar be used, the amount of free carbon not to exceed 5 per cent.

(6) That in treating with the mixture the temperature of the solution in the cylinder be not less than 180 deg. F.

The committee recommends the adoption of these precautions as modified, and that they be inserted in the Manual.

WATER IN CREOSOTE.

One of the most important questions which arises almost daily in connection with the treatment of timbers with creosote is the question of admixture with certain percentages of

water. The committee has thought it advisable to present the following information with reference to this subject:

How does water get into creosote? A certain amount of water becomes mixed with creosote during the process of manufacture. During the distillation of the tar, where steam is sometimes used for agitating the stills, some of this steam vapor is condensed with the creosote in the condensing coils, and goes with the oil through the receiving tanks into the collecting tanks, and finally into the storage tanks there being no possible way of separating the water from the oil during its progress to the storage tank, as water present in small quantities does not separate by gravity except on long standing.

When steam is not used for agitation, air is generally used, and this air, of course, carries some moisture which condenses in the oil, although the amount of water introduced in this way would be much less than where there is steam agitation. In this connection, we might say that the use of steam agitation is limited, and most of the plants are now using air.

All coal tar contains water in greater or less degree. This usually is removed with the light oil and does not ordinarily constitute a source of water in creosote oil, although if the water is present in the tar in an unusual amount, it may not be entirely removed during the early stages of distillation and some may remain in the creosoted oil.

Water may enter the condensing worm where the vapor pipe passes through the condensing tank. Should any serious leak develop, it would be soon detected, but minor leaks would not be. Sometimes the lines leading from the stills to the storage tanks and from the storage tanks to the shipping point are equipped with inside steam pipes to prevent choking or blocking of the pipes with naphthalene in cold water. Of course, this steam pipe is apt to leak, and such a leak would not be detected until it became serious. The storage tanks in which the oil is kept from the time it is made until the time it is shipped, are almost always equipped with steam coils, and it is customary to keep the oil warm during cold weather. These heating coils sometimes develop leaks.

Where creosote oil is shipped in tank cars, water may get into the oil in the cars through leaky steam coils. Where it is transferred in vessels, a certain amount of sea water may get in through leaky seams or bulkheads.

At the treating plant water may get into the oil during the process of treatment, either through leaky steam coils in the cylinders or storage tanks, or from the timber itself. While the data concerning the actual quantities of water which may get into the oil during treatment from the timber itself are meager, it is a matter of general observation that, particularly during the early months of the year (especially in northern states), when timber is wet due to winter exposure, or, as is frequently the case, covered with snow, the water percentage in the oil, as used in treatment, rises. So, for instance, in 1913, at one of the northern plants, the average sample of oil for April had 5 per cent water in it. During the next two weeks, or early in May, the water percentage in the average sample dropped to 1.4 per cent, and during the last two weeks in May it dropped to 1 per cent. There was a very heavy rainfall during April, and early in May there were seven days of rain. As soon as a number of days of good, sunny, dry weather occurred, the water percentage in the oil, as actually used in treatment, dropped immediately. There was no leakage in the steam coils, and in no case was live steam admitted into the cylinder.

Where ties or timbers are steamed as a part of the treating operations, a certain amount of water may get into the creosote from the condensed water forming on the timbers and from some of the water which comes out of the timbers during the pressure and vacuum periods.

Another point at which water comes into creosote is in storage tanks which have no roof. Such storage tanks usually have to be provided with what is known as a water seal. Experience has shown that no distinct dividing line forms between water and creosote, and the result is that the upper 2 or 3 ft. of oil in the storage tanks are more or less mixed with water.

The actual determination of the percentage of water contained in a tank car or storage tank is a comparatively simple matter after a sample has been obtained. The accuracy of the determination will depend largely upon the method with which the sample is taken. Where it is possible to obtain a drip sample, this method is to be preferred, providing the sampling continues for the entire period of the emptying of a tank car. This is, however, frequently impossible, particularly where a considerable percentage of water is suspected, and where it is not desirable to empty the tank car. It is also impossible to use the drip sampling in the case of storage or working tanks.

Various schemes have been used for obtaining an average sample where the drip sample is not possible. One of these consists in constructing a thief, composed of a long tin or zinc tube 3 or 4 in. in diameter and 18 to 24 in. long, weighted at the bottom. This tube has a cover in which a small round hole is cut. The tube is dropped rapidly to the bottom of the tank car and then is pulled up slowly through the oil at such a rate of speed that when it reaches the surface of the oil it is full. A little practice will enable the operator to gage the rate of filling with a fair degree of accuracy.

Another method consists in taking a cross-section. For this purpose a glass or metal tube about 2 ft. long is usually used, set in metal collars, with a valve at the bottom. The tube is lowered into the oil with the valve open, and when in position the valve is closed and the tube pulled out. An exact measurement is made of the depth of the immersion. The per cent of water is determined in this column and the actual amount of water for the number of gallons represented by the section is determined.

Where water has gotten into the oil beyond a certain limit, every effort should be made to reduce the quantity. This may be accomplished by allowing the oil to settle in the tank car or storage tank, and, after standing for a number of days, the water should be syphoned off. If an examination of the oil still shows excessive water, the oil should be heated and allowed to stand for a further period. It frequently happens that, in spite of long standing, much of the water cannot be separated in this manner. In some cases the boiling-out process has been adopted, that is, the oil is put into the treating cylinder and heated until most of the water has been boiled away. Where an efficient condenser system is used there will be only a minimum loss of oil.

A third means of separating water from oil has recently been suggested, namely, the use of centrifugal pumps, after the pattern of the centrifugal apparatus used in sugar mills. Unfortunately, the capacity of these machines is as yet very small, not exceeding 300 gallons per hour.

While it is desirable to use as water-free oil as possible, the committee finds that this is not always possible. There should be a number of well-defined rules in connection with the water allowance, however, and the committee recommends the adoption and insertion in the Manual of the following as indicative of good practice:

(1) *Allowable Limits of Water.*—The use of creosote in treatment containing up to 3 per cent water is permissible. Where the quantity exceeds 3 per cent, proper allowance shall be made, but under no circumstances shall timbers be treated with oils having more than 6 per cent water.

(2) *Measurement of Oil.*—In all cases where water separates from the oil in the tank or car, the water should be taken off to as great an extent as practicable and the oil measurement then should be made from the point of separation between the remaining water and oil as nearly as this can be determined. This refers to the physical process of measurement.

(3) *Sampling of Oil for Water Content.*—In sampling oil a drip sample should be used in taking samples from cylinders during treatment, and an approved cross-section tube should be used for taking samples from tanks or tank cars.

(4) *Storage Tanks.*—All storage tanks should have a watertight roof.

RECORD OF SERVICE TESTS.

The tabulated record of the service of the ties in the several sections of test track on the railroads reporting such tests, which has become a permanent feature of this committee's yearly report, was again presented, revised to show the status of the tests at the latest inspection.

As some of the service tests covered by this tabulation are now of considerable age, it seemed desirable to supplement the tabulation with a more detailed history of these tests. With this in view inspections were made by members of the committee of such of these tests as are of eight or more years' duration.

Most of the tests are not yet complete and final conclusions cannot be reached.

Dr. Irving W. Bailey, of the Bussey Institution of Applied Biology, Harvard University, presented a paper, entitled "The Effect of the Structure of Wood Upon Its Permeability," which was presented as an appendix.

CONCLUSIONS.

It is recommended that the following be adopted by the Association and inserted in the Manual:

(1) The Use of coal tar in creosote:

(a) The Specification for a Creosote-Coal Tar solution.

(b) Paragraphs 1 and 2, referring to the quality of the coal tar to be used in the solution.

(c) The six precautions to be followed in the use of coal tar in solution with creosote.

(2) Water in Creosote:

The four rules relating to the water allowance in creosote.

OUTLINE OF WORK FOR 1915.

The committee recommends:

(1) Continue the study of the relation of water to creosote.

(2) Derive conclusions from the results of exposure tests of material tested with water gas tar oil.

(3) Report on methods of accurately determining the absorption of creosote.

(4) Continue the compilation of service test records, with detailed reports of inspections by members of the committee of ties in track treated by the various processes.

(5) Study the relations of amount of preservative and depth of penetration to the resistance of the material against decay.

Earl Stimson (B. & O.), chairman; E. H. Bowser (I. C.), vice-chairman; H. B. Dick (B. & O. S. W.), C. F. Ford (C. R. I. & P.), Dr. W. K. Hatt (Purdue Univ.), V. K. Hendricks (St. L. & S. F.);, George E. Rex (A. T. & S. F.), E. A. Sterling (Cons. Engr.), C. M. Taylor (P. & R.), C. H. Teesdale, Dr. H. von Schrenk (Cons. Engr.), T. G. Townsend (Southern).

Discussion on Wood Preservation

The report was presented by Chairman Stimson.

The President: The specifications on the use of coal tar in creosote as submitted, without objection, will be taken as adopted for insertion in the Manual, with the understanding that there is to be a note attached that will express the views of the committee on the use of the specifications.

The remaining suggestions under this subject were also accepted.

The four rules relative to water in creosote were adopted.

BALLAST

The following subjects were assigned for investigation:

(1) Continue the investigation of the proper depth of ballast of various kinds to insure uniform distribution of loads on roadway, conferring with other committees.

(2) Continue study of subject of ballast sections, with particular reference to the use of a sub and top ballast.

Specifications for Gravel Ballast.

Class A Roads: Bank gravel, which contains more than 2 per cent. of dust or 40 per cent. of sand, should be washed or screened. Washed or screened gravel should contain not less than 25 per cent., nor more than 35 per cent. sand. Class B Roads: Bank gravel, which contains more than 3 per cent. of dust or 60 per cent. of sand, should be screened or washed. Washed or screened gravel should not contain less than 25 per cent or more than 50 per cent. of sand. Class C Roads: Any material which makes better track than the natural roadbed may be economically used.

H. E. HALE,
Chairman Committee on Ballast

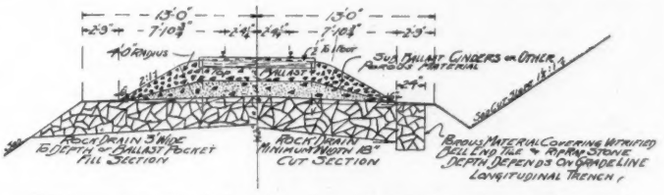
Specifications for Burnt Clay Ballast.

KIND OF MATERIAL.—Good ballast clay should be heavy and plastic, free from sand, gypsum or other impurities; must not crumble when exposed to air or brought in contact with heat.

LOCATION.—The pit must be located on level or moderately sloping ground, not subject to overflow. A water supply is desirable and it must be borne in mind that the sulphurous and carbonaceous gases liberated during the burning period damage the surrounding vegetation and make habitation in the near vicinity very disagreeable.

TEST.—The location site should be thoroughly tested to determine the quality of clay, the depth and uniform consistency of the deposit and small quantities should be burned in test kilns to show the quality of ballast to be secured.

BURNING.—Fuel should be fresh, clean slack and arrangements should be made to secure a constant supply. One ton of slack coal is sufficient for the perfect burning of four



Proposed Ballast Section for Single Track on Tangent.

cubic yards of acceptable ballast. From 1 to 1½-in. layer of slack are alternated with from 10 to 12-in. layers of clay, a new layer of slack and clay being applied to the fire every five or six days. Fires once started must be kept steadily and uniformly burning. To insure thorough and proper burning of the clay, the top and face of the first must be frequently raked down, to avoid clinker or black spots, caused by too much or too little air. When fully burnt a proper ballast clay becomes red in color, due to its high percentage of iron compounds; when underburnt the clay will show a yellow color.

SIZE.—Burnt clay ballast should be crushed or broken, if necessary, so that the largest piece will pass through a 4-in. ring.

DENSITY.—The finished product should absorb not to exceed 15 per cent. of moisture by weight.

STUDY OF BALLAST SECTIONS, WITH PARTICULAR REFERENCE TO THE USE OF SUB AND TOP-BALLAST.

This subject was first referred to the Ballast committee in 1913 and a sub-committee was appointed. In the 1914 report standard plans of ballast sections of various railroads in the United States and Canada were given in the report, and a proposed Class A section was submitted for consideration only, in the form of a progress report. During the year this proposed section has been compared with similar sections in service, and also studied and compared with standard plans of ballast sections of various railroads.

The committee made several changes in the proposed section and added a system of drainage which has been tried out and found to be very successful. The diagram of the proposed ballast section hereto attached shows a roadbed 26 ft. wide for single track. This width is considered necessary for a depth of 24 in., with a slope of 2 to 1 on the side and a path 2 ft. 9 in. wide. The committee wishes to call particular attention to the fact that with this depth of ballast the 2 to 1 slope on the side and the 2 ft. 9 in. path, the width of the sub-grade will have to be greater than 26 ft, on curves.

The committee recommends that this ballast section, with 24 in. of ballast under the tie, and roadbed 26 ft. wide on single tracks on tangents, be adopted as recommended practice for "Class A Track."

The committee further recommends that the slopes be sodded up to the top of the slope, but not beyond, as the application of sod on slopes shown in the present Manual lacks uniformity.

THE PROPER DEPTH OF BALLAST OF VARIOUS KINDS TO INSURE A UNIFORM DISTRIBUTION OF LOADS ON THE ROADWAY.

The committee again unanimously recommends that the test outlined in the 1913 report and 1914 report be made under regular traffic. The committee further recommends that continued efforts be put forth to secure the recommended test on one or more railroads, conferring with other committees. The corroborative results of comparing this test with others will, in the opinion of your committee, be extremely valuable.

BALLAST COMMITTEE'S WORK FOR NEXT YEAR.

(1) Continue investigation of proper depth of ballast of various kinds to insure uniform distribution of loads on roadway, conferring with other committees.

(2) Report on the best methods and cost of applying ballast, including the advisability of applying ballast by contract, and the organization of the most economic ballast gang if applied by railroad forces. Also the use of the pneumatic tamper, and the use of the spreader for forming the ballast shoulder and the path.

(3) Report on the comparative merits of different stones used for ballast, and gravels which disintegrate when exposed to the atmosphere.

H. E. Hale, chairman; J. M. Meade, vice-chairman, (A. T. & S. F.); L. W. Baldwin (I. C.), D. P. Beach (P. L. W.), W. J. Bergen (N. Y. C. & St. L.), T. C. Burpee (Cons. Eng.), O. H. Crittenden (I. & G. N.), J. M. Egan (I. C.), T. W. Fatherson (C. G. W.), H. L. Gordon (B. & O.), Geo. H. Harris (M. C.), C. C. Hill (M. C.), S. A. Jordan (B. & O.), William McNab (G. T.), S. B. Rice (R. F. & P.), E. V. Smith (B. & O.), D. L. Sommerville (N. Y. C.), F. J. Stimson (G. R. & I.), D. W. Thrower (I. C.), R. C. White (M. P.).

Discussion on Ballast

The report was presented by Chairman Hale.

The changes up to the specifications for Burnt Clay Ballast were adopted.

Chairman Hale: The committee recommends a new specification for burnt clay ballast. The entire specification is changed.

J. G. Sullivan (Can. Pac.): One of the clauses here reads, "When fully burnt a proper ballast clay becomes red in color." That is true, if there is iron in it. I think it might be well to add, "when the clay contains iron."

J. L. Campbell (E. P. & S. W.): In referring to the kind of material, I think the first line should read, "good ballast clay is heavy and plastic," rather than, "should be heavy and plastic."

The President: The committee accepts both suggestions.

A. M. Van Auken: There is quite a difference in the amount of coal needed to burn this clay into ballast in the different parts of the country.

The President: The committee suggests the insertion of the word "generally" before the word "sufficient" in the third line of the paragraph on "Burning" to cover this criticism. If there are no other comments on the specifications for burnt clay ballast they will be considered as adopted.

Chairman Hale: The study of ballast sections, with particular reference to use of sub and top ballast, has been given consideration for two years by the committee. The ballast sections are recommended for adoption.

C. E. Howard (Con. Eng.): I think you will find in some cases of deep rock cuts that the cost of cutting a wide roadbed over the narrowest one you could reasonably get along with would probably amount to more than the entire cost of the maintenance of a mile of track.

C. F. Ford (C. R. I. & P.): Has the committee given consideration to the fact of the tendency to increase to 14 ft. centers?

Chairman Hale: The committee did give consideration to this center distance of 13 ft. and 14 ft., and endeavored to select one which would show about the average conditions on the railroads, and also the committee did not like to add another foot to the roadbed if they could avoid it. The 24 in. of ballast is based on the two tests printed in the previous proceedings. Twelve inches of ballast is considered by your committee as too small an amount for heavy traffic. We had that in view when we recommended the 13 feet between centers in the two tracks.

Hunter McDonald (N. C. & St. L.): I have always felt that there was no necessity for banking the ballast up against the end of the ties. On the other hand, I think it is a detriment to the track. As the ballast at the end of the tie becomes clogged with any dirt it begins to act as a pump and pumps the clay up through the bottom of the ballast and fouls the ballast. The sections which are proposed here, it seems to me, could only be carried out on roads having sufficient tracks, to enable them to shift the traffic while this section was being introduced. On single track roads it is an impossibility. I believe a great deal of the foul ballast is due to the fact that it has been tamped too much. I have recently found a limestone paste that will pass through a number two hundred sieve, which, when mixed together, without any cementing whatever, will pull eighty pounds. Under these conditions it seems to me that if we continue to powder our limestone dust under the ties by tamping we will produce a paste which will cause churning, especially so if the border is clogged.

Mr. Ford: We have used a 12-in. ballast with the first 8 in. of coarse rock resting on the cinders and the last 4 in. resting on the crushed gravel, and the results have been surprising. I do not believe we thoroughly understand the action of ballast on the sub-grade. I do not think that we are in position to say what the proper depth of ballast should be, so much depends on the sub-grade. But certainly the distribution of the load on the sub-grade is better secured by using very much coarser ballast for a portion of the way than it is by putting a classified material, such as specified in the Manual, for the entire distance. In connection with this matter of clogging the sub-grade, I think there is a good deal of misapprehension. Mr. McDonald is undoubtedly correct. On the other hand, other roads can bring up the same objection in rebuttal. I think the trouble is due to the way of placing the material on, and the selection of the material. In some cases, to my certain knowledge, the ballast has extended down to at least five feet, but it is no longer ballast. It becomes part of the roadbed, due entirely to the clogging which Mr. McDonald has spoken of.

Chairman Hale: The usual form of providing ballast in the case of a new track is to make the ballast of gravel or cinder, and on top of that it was assumed would be placed the stone ballast at a later date. This section was selected in this form, so that that could be done. With regard to the shoulder or boxing in the object your committee desired in that was not so much for holding the track in line, although that is essential, but also to thoroughly support the end of the tie and to prevent the ballast from kicking from under the end of the tie. One railroad, the officers of which understood they had six inches of ballast, found that they had from one foot to two feet, and their plan, after they found that, instead of adding ballast, which they themselves were prepared to use, was to scrape off the shoulder, and give the ballast which was there a thorough drainage.

J. M. Meade (Vice-Chairman): We have had a great deal of trouble with the ditching machines digging the tile out of the point of the ditch, and they started the plan of putting it near the center of the track, but out of the point of the ditch. The plan which we have presented shows it both ways.

Hunter McDonald: In answer to Chairman Hale's statement about the necessity for maintaining the shoulder ballast at the tie. If a border 10 in. wide is left from the end of the tie at a level with the bottom of the tie it will hold the ballast in there just as well.

Earl Stimson (B. & O.): Our experience on the Baltimore & Ohio supports the statements of the chairman, namely, that it is necessary to have the ballast pretty well banked at the end of the ties in order to properly support the ties.

A. S. Baldwin (I. C.): It seems to me that the question of shoulder in the ballast is largely dependent on the character of the sub-grade. I think it cannot be denied that the shoulder does furnish an excellent brace to the tie so far as maintenance of line is concerned. At the same time there are some sub-grades so soft that it is almost impossible to maintain it. In my experience I found it a good plan to keep the shoulder where it could be kept without an unreasonable amount of churning.

C. E. Lindsay (N. Y. C.): Mr. McDonald is entirely right in saying that ballast that has become so foul as to retain the water around the end of the tie is very objectionable, and where that condition exists we clear away the ballast down to the level of the bottom of the tie. Anyone who will examine the bed disclosed by the removal of an old tie will find it packed full almost to a glazed surface in many cases and almost impervious to water. The drainage in that case must be into the ballast at the side, and where we clean the ballast we clean it as deep as we can go between the ties clear across the track so that we get a drainage in that way from the bed of the tie into the space between the ties and then out to the side. We find that clean ballast, either stone or gravel, at the end of the tie of decided benefit in maintaining the line. Everybody knows the proper place to support the tie is a space three feet equally distant from each side of the rail.

John R. Leighty (Mo. Pac.): I notice the drawings show a drain filled with coarse rock. I would say that in a good many cases the effective life of that drain can be materially lengthened by mixing cinders with the rock. If the character of the sub-grade is such that it carries a great deal of earth with the water it will clog the interstices between the rocks in a comparatively short time, whereas if cinders are put in they act as a sort of filter and will not materially, if at all, deteriorate the drain and the result is a long life.

Mr. Meade: I will say that the centers, in the course of a few years, will rot and will clog the French drain. As a substitute for this we have been using crushed rock on top of coarse rock.

Mr. Baldwin: I tried putting drain tile vertically below the end of the ties and found it a very excellent way for draining out the water holes. For a few years it gave excellent results, but the pressure from the roadbed and the fine dust caused it to fill up almost invariably. Finally we got a good deal better results by using a large tile.

Chairman Meade: We tried that for six or eight years.

Mr. Safford: We have placed in the past too high a value on the qualities of the farm tile, which permitted water to be absorbed through it. I think the bulk of the water that gets into the tile comes through the joints. We are bound now to use the bell-shaped harder burnt tile, under most conditions, to a much greater extent than we did in the past, due to the fact that our wheel loads are much heavier. I think our trouble has been in the past that we have not been able to tamp the material over the tile hard enough to resist the lateral action due to the heavier loads. My experience has been that we get equally good results from drainage standpoints from bell tile as from farm tile.

Mr. Campbell: Referring to these ballast sections, I notice that the sub-grade is sloped from the center of the roadbed.

Chairman Meade: The committee discussed that point. The man dealing with the sub-grade, seeing it washed out after it had been in service for a while, realizes that the top of the sub-grade has not been disturbed very much, and it is ridiculous to suppose that any such line as recommended here could be maintained, but your committee thought it was a step in the right direction, and therefore recommended greater height in the middle, and drainage outside if possible.

J. B. Jenkins (B. & O.): I wish to ask if the committee would not consider calling this clause on roadbed Clause AA, so as to preserve our former classifications, A, B and C.

Mr. Meade: The committee is heartily in sympathy with the suggestion that other revisions are necessary, but this was such a step from what we had in the Manual to the proposed one that we wished to recommend this to the Association first for consideration, and then at a later date to revise the remaining sections in line with the wishes of the Association.

J. R. W. Ambrose (Tor. Term.): I think we are making a mistake if we adopt this section at this time, because, in a way, you are tying the hands of other committees that are now investigating this question. I think very few of us would recommend the construction of a 25-ft. roadway for single track to-day.

Mr. Meade: The committee is working in harmony with the other committees. The Roadway Committee was notified of our meetings and we have been in conference with them. We did not have time to get their approval of the 26-ft. roadway, although we have taken it up with them. In regard to the width, it all depends on the depth of ballast. If the depth of ballast is assumed to be 24 inches, the other will follow. We hear of roads considering 125-lb. rail. The weight of the coal cars is increased over the old coal cars, and the committee feels that something ought to be done now to have a section which is practically, as nearly as we can get it, the recommended practice of the railroad. It may be revised in the future. We don't say it will not be, but it is the best practice that we know of at the present time. We find two roads already making proposed sections, and we feel the others would be helped by having something of this sort.

The President: The committee has moved the adoption of sections for insertion in the Manual.

(A rising vote was taken on the motion, which was lost, and it was referred back to the committee for further investigation.)

Mr. Meade: The committee has one further recommendation in regard to the track section. (Reading the last paragraph under the Study of Ballast Sections.)

The President: The recommendation will be taken as having been approved by the convention.

Mr. Meade: The committee had also referred to it the proper depth of ballast on the roadway. What the committee wanted was about $3,000, and it was suggested that we try to get that amount from thirty railroads. We would like to hear from the convention as to the possibility of getting $100 each from different railroads. If we can get the $3,000 we can make this experiment, and I think the whole thing depends on this experiment.

The President: This recommendation of the committee has been before the Board of Direction in the past. Funds did not seem available with which to carry on the work. I can think of no action that the convention can take at the present time except to refer it to the Board for further consideration.

J. B. Jenkins (B. & O.): I would suggest, if the ballast committee applied to the different railroads of the country to make this test on a 10-ft. section of track, perhaps several 10-ft. sections for each railroad, that it could be done at very low expense, and I have no doubt a number of the railroads would be willing to make the test at their own expense. By having a number of 10-ft. sections and different classes of material, they would get much more data than they would by making the test for which they want the $3,000.

STRESSES IN RAILROAD TRACK

The special committee on Stresses in Railroad Track was formed by action of the Board of Direction November 20, 1913. A similar committee was created by the Board of Direction of the American Society of Civil Engineers November 12, 1913. By action of these two bodies the two committees have the authority to co-operate, and this co-operation is being carried on. The Board of Direction of the American Society of Civil Engineers made an assignment of funds for the work of the Committee March 4, 1914, and a contribution toward the expenses of the tests was later received by the American Railway Engineering Association from the United States Steel Corporation. It has been decided that the first work shall include the development of instruments and methods for tests on track, and that the preliminary tests on track shall include observations of the equilibrium depression curve of the track

A. N. TALBOT,
Chairman Committee on Stresses in Railroad Track.

under static load (the measurement to include rail, ties, ballast and roadbed); and also measurements of the distribution of strains in the rail.

During the summer and fall plans have been developed and a beginning made. The work has included (a) a study of the problem; (b) development of instruments and methods of carrying on the tests and trying these out in field and laboratory, and (c) static tests on railroad track with heavy locomotives and with single concentrated load. These tests were made on the track of the Illinois Central, near Champaign, Ill. A test party was organized and a start was made on the field tests, and these tests were carried on until unfavorable weather interfered with the work. The work of computation, making records and developing apparatus has since been continued. Enough experience has been gained to show that the methods used are practicable. During the winter it is expected that some laboratory tests will be made on ballast and on rail joints. Preliminary arrangements have been made for tests on the Baltimore & Ohio and on the Delaware, Lackawanna & Western. It is planned to carry on the test work during the coming season.

The Engineering Experiment Station of the University of Illinois is co-operating with the committee on this work through the use of its laboratories and its staff, especially through the assistance of Prof. H. F. Moore, in the development of apparatus and methods of tests. It is expected that this co-operative work will be of great assistance to the committee.

A. N. Talbot (Univ. of Ill.), chairman; W. M. Dawley (Erie), vice-chairman; A. S. Baldwin (I. C.), J. B. Berry (Cons. Engr.), G. H. Bremner (I. C. C.), John Brunner (Ill. Steel Co.), W. J. Burton (M. P.), Chas. S. Churchill (N. &

W.), W. C. Cushing (P. L. W.), P. H. Dudley (N. Y. C.), H. E. Hale, Robt W. Hunt (Cons. Eng.), J. B. Jenkins (B. & O.), Geo. W. Kittredge (N. Y. C.), P. M. LaBach (C. R. I. & P.), C. G. E. Larsson (Am. Br. Co.), William McNab (G. T.), G. J. Ray (D. L. & W.), A. Reichmann (Am. Br. Co.), E. Stimson (B. & O.), F. E. Turneaure (Univ. of Ill), J. E. Willoughby (A. C. L.).

Discussion on Stresses in Railroad Track.

The report was presented by Prof. Talbot.

Prof. Talbot: Work is to be done with different types of locomotives, to determine the effect of wheel loads and wheel spacings. It is to be done at different rates of speed to endeavor to determine the effect of speed upon the stresses. The measurements of the stresses in the rail will be made by strain gages at different points along the roadbed. The committee has been working with different depths of ballast, with different sizes of ties. Some thought has been expressed as to different tie spacing. An instrument has been developed to measure the pressure in the ballast, that is, the distribution of the vertical load produced at any point through the depth of the ballast. In addition to that, I want to say that this is preliminary work, rather elementary in some respects; an endeavor to find some of the laws which may be used for p.anning other work, and for analyzing and drawing conclusions from the tests. That gives a general notion of what we have in mind for this season.

MASONRY

The subjects assigned by the Board of Direction were:

Complete the report on principles of design of plain and reinforced retaining walls and abutments. (No report.)

Collect data concerning the cost and methods of construct-

F. E. SCHALL,
Chairman Committee on Masonry.

ing concrete piles, and make recommendation as to their use. (Reports progress only.)

Report on the cost, appearance and wearing qualities of various methods of surface finish for concrete. (Reports progress only.)

Joint committee on Standard Specifications for Cement.

Joint committee on Concrete and Reinforced Concrete.

JOINT COMMITTEE ON CONCRETE AND REINFORCED CONCRETE.

The committee held two meetings during this year, at which the reorganization of the joint committee was thoroughly discussed and the financial aspect of the committee considered. At the meeting held June 3, 1914, sub-committees for the investigation of certain phases of reinforced concrete work were appointed. By instructions from the Board of Direction, further attendance at the joint committee meetings is not desirable.

COMMITTEE C-1, STANDARD SPECIFICATIONS FOR CEMENT, AMERICAN SOCIETY FOR TESTING MATERIALS.

Meetings of this committee were held on April 28 and July 1, 1914; at the first meeting, special committees on "Accelerated tests of the consistency of volume of cements" and on standard screen scale and method of standardizing sieves were appointed. At the meetings of this committee reports were received that the Conference committee on "Standard Specifications for Cement" was making progress and expected to reach a satisfactory conclusion at an early date, but so far this has not been accomplished.

The sub-committee on Accelerated Tests met on July 1, 1914, and discussed the question of these tests from various points of view; the committee expected to obtain some valuable information on this subject from abroad, but by reason of the disturbed conditions of the European countries little information may be expected from that source; the committee so far has not undertaken to make any tests.

NEXT YEAR'S WORK.

It is recommended that the subjects of cost and method of constructing concrete piles, and the cost, appearance and wearing qualities of surface finish of concrete be reassigned for further examination and report.

It is also recommended that the subject of certain typical designs of foundations for piers, abutments, retaining walls and arches in various soils and depth of water (not including pneumatic foundations) be assigned for investigation and report.

F. E. Schall (L. V.), chairman; F. L. Thompson (I. C.), vice-chairman; R. Armour (G. T.), J. C. Beye (C. R. I. & P.), C. W. Boynton, H. A. Cassil (B. & O. S. W.), T. L. Condron (Cons. Engr.), J. K. Conner (L. E. & W.), L. J. Hotchkiss, Richard L. Humphrey (Cons. Engr.), J. H. Prior, R. A. Rutledge (A. T. & S. F.), G. H. Scribner, Jr. (Contr. Engr.), Job Tuthill (K. C. T.), J. J. Yates (C. R. R. of N. J.).

APPENDIX A.

CONCRETE PILES, COST, METHOD OF CONSTRUCTION AND RECOMMENDATION FOR THEIR USE.

The concrete piles generally used are of the reinforced type, though in several cases plain concrete piles have been used.

They are usually of 16-in. short diameter, whether square or octagonal. The Santa Fe varies the short diameter, using the formula $D = 7$ in. $+ \frac{1}{4}$ in. L, where L equals length of pile in feet. Concrete piles are used with both a tapered and a straight section, the latter type being more commonly used.

A large variance is shown in the amount of steel reinforcement used, both longitudinal and transverse. The greater portion of the piles have ¼-in. rods for transverse reinforcement, whether spiralled or hooped. Steel mesh is used in a few cases and in one case additional steel reinforcement is used in the head of the pile. The Burlington is one of the roads that uses steel mesh for reinforcement.

The cost of the concrete piles at the point of manufacture varies considerably, probably due in a large measure to the method of bookkeeping, or as to what is considered a proper charge against the actual cost of the piling; the number of piles manufactured and the available plant and labor for manufacturing the piles are also factors that may influence the cost.

The variation in the cost per linear foot of pile is also due to the use of different quantities of steel reinforcement, some roads using a design providing considerably more steel than others. For instance, the cross-sectional area of steel used by the Burlington runs 4.25 lbs., of the Illinois Central 12.5 lbs., and of the Milwaukee 17.5 lbs. per linear foot.

The cost of driving the piles also varies considerably, but this should be expected, as the nature of the soil, the accessibility of the work, the traffic conditions and the number of piles driven at a given structure affect the cost of driving to a certain extent. Thirty-five cents per linear foot, however, seems to be a fair average cost under ordinary conditions. This cost includes handling costs, which vary from 10 to 12 cents per linear foot.

Several of the answers received to a circular request for information show that it costs little more to drive concrete than wooden piling.

The general opinion seems to be that in cases where there is permanent moisture and no danger of future drying out, wooden piling is the cheaper; where the line of permanent moisture is low, concrete piling is the most economical. No Eastern railroads seem to have used concrete piling for bridge bents. Several of the Western railroads have used this to a considerable extent and found it to be good and permanent construction. In many cases concrete piling has been used for supporting small abutments, where placed on embankments, as this type of construction is more economical on account of the saving in the cost of expensive high abutments.

The foregoing, in conjunction with the two summaries of replies, are submitted as a progress report, understanding that the subject will be continued for next year, for the further investigation of the different designs of piles, and to

submit a complete report with certain typical designs of concrete piles, their cost and recommended use.

APPENDIX B.

COST, APPEARANCE AND WEARING QUALITIES OF VARIOUS METHODS OF SURFACE FINISH FOR CONCRETE.

A careful review of the current literature on this subject was made and the committee found a marked lack of reliable information. A circular letter of inquiry was therefore sent to the members of the Association and others interested. Fifty-two replies were received, many of which contain excellent information. A summary of these is made a part of this report, and a number are quoted that contain information covering generally the methods in use and specifications and typical recommendations. The sub-committee feels, however, that the subject requires further study, and that it is not in a position to make final recommendations. The committee presents this report as information.

A review of the answers received gives the following methods as most generally used. Each method has been numbered for reference, the same as in the tabulated summary of replies.

Spading, to Work the Coarse Aggregate Away from the Form to Bring the Mortar Against It.

This method is the one generally used, and where decorative treatment is not necessary furnishes the best finish at the least expense. The surface is generally smooth and nearly impervious to moisture, and its wearing qualities are equal, if not superior, to those of any other method.

Coating with a Wash of Cement.

A wash of usually one part of cement and one part of sand is applied with a brush after the forms are removed. This fills up the pores and covers the small inequalities and wood grain marks and gives a smooth surface of even finish and uniform color. This film of mortar, however, is liable to become checked and hair-crack and often scales; for this reason it is not generally used.

Rubbing.

There are several methods of treatment, as follows:

(a) The forms are removed as early as practicable, prominent joint marks chipped off, and the surface thoroughly wet and rubbed with a cement mortar or carborundum brick.

(b) After the forms are removed the surface is rubbed with wooden floats, keeping the surface well flushed with water during the rubbing and thoroughly washing after the rubbing is completed. The earlier the rubbing is done the better the results. The rubbing removes most of the inequalities, fills the pores and small cavities, and gives the surface a uniform finish and appearance, and does not flake or scale.

Removing the Outside Mortar to Expose the Coarse Aggregate.

There are several methods of accomplishing this result, all dependent on the use of a surface finish or coating at least one inch thick, composed of prepared aggregate, which coating is deposited as the placing of the concrete proceeds.

(a) Wash the surface immediately after the forms are removed, exposing the aggregate, which is usually done by scrubbing with stiff brushes of either bristle or wire, and water, rinsing the surface clean, keeping it moist and protected from the sun for about three days.

(b) Treat the surface with an acid, usually commercial hydrochloric and nitric. The acid attacks the cement and exposes the aggregate. The amount of dilution of the acid is usually obtained by experiment and varies with the age of the concrete.

(c) Removing the outer skin by means of a sand blast: This method has not generally proven successful, as it is very difficult to obtain a uniform surface.

Tooling the Surface of the Concrete, After the Forms Have Been Removed, by Means of Crandall, Bush-Hammer or Other Tools.

This method, applied to the extent of cutting slightly into the aggregate, produces a very attractive surface, and it is the experience of many engineers that for work in which the best possible appearance is desired, bush-hammering provides the desired results at a minimum cost. The best results are produced with spaded surfaces or those composed of special aggregate.

Scoring.

Scoring the surface by means of a system of horizontal and vertical "V" shaped battens placed on the forms to break up the flat appearance, to make a line designating the completion of the day's work, to indicate expansion joints or to produce the effect of courses.

Metal Forms.

Forms of metal or wooden forms lined with metal give a smoother surface than bare wood. The spading is done in the same manner as with wooden forms to push the aggregate back from the face. In doing this an excess or thin skin of rich mortar is brought to the surface of the concrete, and is liable later to develop checks and hair-cracks and become unsightly.

Abstracts of some of the replies received in answer to the circular letter issued by the committee are given below:

C. H. Cartlidge, bridge engineer, C. B. & Q:

"In the beginning of our concrete work in 1889, it was our practice to face the concrete against the form boards by working the grout against the forms. A great deal of rough lumber was used in the early work, and as we enlarged the use of concrete, we tried to improve its appearance by depositing the mortar against the form and filling in back of it with concrete. Another method was to leave the concrete rough and plaster it. In the 25 years that have elapsed since these experiments, it has become evident that the original method is by far the best of the three, and that the more nearly homogeneous the concrete can be maintained the better will be the wearing qualities of the surface and even of the concrete itself. In later work we have adopted the same principle, but have used surfaced forms, even lining them with sheet steel to obtain a smoother surface. This gives the best results for the cost, but at the same time a thin skin of rich mortar or grout is formed against the form and on the outer surface of the work. This checks with minute cracks and in the end will probably be more or less unsightly. It is true that these cracks are very small and there is not the tendency for the film of rich mortar to scale off, which is exhibited in every case in the thicker mortar facing used in earlier work. In 1900 an experiment was made with bush-hammering some concrete which had been faced in the most careful manner by spading against the form; a portion only of the work done at that time was bush-hammered, so that there is an excellent chance to judge of the relative merits of the two finishes. As the result of this it is the writer's opinion that for work in which the best possible appearance is desired bush-hammering provides the desired result at a minimum cost. In a good deal of the work finished by spading against the forms improvement on the surface obtained was made by rubbing with carborundum brick; this gives a good surface and a pleasing appearance temporarily, but it has been found that it is difficult to obtain a uniform texture by this means and that, while exposure does not affect the material itself, it causes the washing away of the fine particles of concrete ground off by the carborundum, so that the work is really not very much better than ordinary spade finish work, unless the grinding is carried to an extreme.

"The cost of the spade finish is practically nothing; it takes little more labor to confine the greater part of the puddling to the concrete on the outside than it does to have the same men do all the puddling in the middle of the mass. The cost of bush-hammering will run from ¾ cent to 2 cents per sq. ft., depending on the age of the concrete, amount of work, accessibility of work, etc.

"It is evident that the rougher the completed surface, the darker it will naturally become by exposure, smoke and weather, as every indentation must receive and retain some coloring matter from the smoke. On the other hand, such a thing as an absolutely plain surface is a practical impossibility. There will be slight waves, small ridges, etc., left by the seams in their forms and their slight distortion, and where a spade finish alone is used the contrast between the dark markings in the seams and the lighter places in the smooth surface is disagreeable in effect, while by bush-hammering an effect of uniformity of texture is obtained, which is much more pleasing to the eye. The bush-hammering has also the effect of cutting away the rectangular markings of the face, which are particularly objectionable from the standpoint of appearance.

"The writer believes that the best and most economic finish for concrete is obtained by bush-hammering, and where the process is carried to such an extent as to expose the aggregate and slightly to cut into it, very beautiful results may be obtained."

George W. Kittredge, chief engineer, New York Central:

"The cost of finishing surfaces with a wooden float while concrete is green is about one cent per square foot. After the concrete has hardened somewhat, and the use of a cement or a carborundum brick is necessary, the cost is increased to about two cents per square foot. The cost of troweling and using a dot roller on walks and platforms is about 1½ to 2 cents per square foot. The above average prices are for all labor and material, including any scaffolding required. I have

no record of actual prices of other methods of finishing surfaces.

"As a general proposition, I think the best manner of finishing a concrete structure is by the wooden-float method, as it leaves the concrete in a more natural state, is cheaper and has a better appearance in the long run. Application of cement on the surface or the use of a cement brick generally makes a white finish, which is more susceptible to discoloration and liable to wear away unevenly.

"Concrete surfaces should be finished in above manner whenever they are exposed, or where it is desired to obtain as much density as possible for waterproofing purposes. I do not think surfaces should be tooled, scraped or treated with an acid, except where the surfaces have been specially prepared and artistic finishes are required. Concrete walks and platforms troweled and surfaces roughened where they are exposed to weather, I think, give the best result. Floors usually require special consideration.

"Surfaces finished smooth are less susceptible to discoloration from smoke and the weather than when untreated. However, tooled surfaces, I think, have the opposite effect."

L. D. Hadwen, engineer of masonry construction, Chicago, Milwaukee & St. Paul:

"In addition to the ordinary surface obtained by spading, we have used a surface finish obtained by using a sand blast, as was done at the Columbus depot; a treatment of the surface with dilute acid to remove the surface mortar, as was done in the Missoula depot foundation; a brushed surface to remove the mortar and show the rough aggregate; removal of the mortar skin by bush-hammering; and treatment of the mortar surface obtained by spading, chiseling off board marks and rubbing the entire surface with emery.

"A special mortar surface was formerly obtained by the use of a steel gage with angle-irons fixed to create a space about 1½ in. deep between the form surface and the body of the concrete. This space was filled in with mortar and the gage removed. This method is unnecessary, as an equally good mortar surface can be obtained by spading the aggregate back.

"In building the Miles City depot foundation, the forms were lined with building paper with a view to getting a smooth finish, free from all board marks. The wrinkling of this paper caused a wavy finish and the surface approximated that of bridge stone, producing a freak appearance and is not a desirable finish.

"Whitewashing surfaces with a liquid grout, or with a cement wash, is contrary to our practice and undesirable. It is only a matter of time before any such wash will check and scale. Some experiments have been made with coloring matter, both lampblack and ochre, with the idea of getting a surface of a definite tint. The addition of any coloring ingredient to an aggregate is to be deprecated, because it is very difficult to insure uniformity in the mixture, and the result is liable to be a surface that is blotchy.

"For wearing surfaces, such as floors with heavy trucking, the use of a special aggregate may be desirable. On some of our shop floors, granite screenings have been used for this purpose to give a granitoid surface. We have also used finely divided iron in some experimental sections of freight house, and a hard-wearing surface seems to be obtainable by incorporating such material or other patented preparations in the wearing coat. Except where especially dustless floors are desired, it does not appear necessary to go to additional expense for this purpose."

Discussion on Masonry.

Chairman Schall: In regard to the change in the Manual the committee recommends one change as to the stress in the reinforcement to loads from 17,000 to 16,000 lbs. so as to agree with the requirements in the specifications for iron and steel structures.

The President: The change will be made. If there is no objection to the definitions the addition will be made.

Chairman Schall: For several years the question of getting a revised specification for cement has been under consideration by a joint committee of the engineering societies. However, conditions have arisen that have put this matter back further and the committee is not willing at this time to recommend striking out the old specifications. We prefer to work along those lines until we can get something better. In regard to the committee on reinforced concrete, the workings of that committee have not been as harmonious as you might expect, more particularly due to a misunderstanding about the representation of certain organizations with the American Society for Testing Materials. This so-called difference has been adjusted to a considerable extent, but for a number of reasons the Board of Direction has felt that it is not desirable for this committee to meet with the joint committee. Another point on the reinforced concrete work that was assigned to the Masonry Committee, was to complete the work on reinforced concrete structures. This matter is tied up with the financial capacity of the organization to furnish funds to make tests of earth pressures, and for that reason this sub-committee has not presented a report. It is hoped that every man that has any facilities to furnish any data will furnish it to the Masonry Committee, and the committee in turn will get in contact with the American Society of Civil Engineers so as to get information on this important subject.

R. L. Humphrey (Con. Eng.): The Board of Direction accepted the invitation to become a member of the joint committee, and they have been co-operating in joint action. That committee has sub-committees at work and they are drafting further modifications of the report already prepared, with the hope of finishing their work at an early date. This matter of re-enforcement is under consideration by that joint committee, which is composed of committees of the American Society of Civil Engineers, the American Society for Testing Materials, and of this Association. It would seem to me that it would be desirable that the Board of Direction be asked to reconsider the action that it was undesirable to further co-operate. I would suggest the desirability of referring this matter of re-enforcement of concrete and the continuation of the representation on the joint committee on concrete and re-enforced concrete to the Board of Direction for their consideration.

The President: It will be handled in that way.

WOODEN BRIDGES AND TRESTLES

The following subjects were assigned:

(1) Continue study of relative economy of repairs and renewals of wooden bridges and trestles.

(2) Report on design of docks and wharves.

E. A. FRINK,
Chairman Committee on Wooden Bridges and Trestles.

(3) Report on developments in practice of ballast deck trestles since previous report.

(4) Report on use of lag screws for fastening guard timbers.

RELATIVE ECONOMY OF REPAIRS AND RENEWALS OF WOODEN BRIDGES AND TRESTLES.

During the current year the sub-committee sent to various railroads letters containing questions bearing upon the method of repairs and renewals of wooden bridges and trestles. Numerous replies to these have been received, showing a varity of information and practice. The committee has given these replies proper consideration, and as a final report, recommends the following conclusions:

It is good practice to repair wooden bridges and trestles by parts until such time as the general condition of the structure requires entire renewal.

DESIGN OF DOCKS AND WHARVES.

During the past year the committee has collected considerable material showing many forms of docks and wharves, and much variety of practice. It is the intention to carry this

study still farther and attempt to develop a type or types of structures that may be recommended as suitable for general use; recommendations to be confined to sub-structures or up to the dock or float level, and to consider both all-timber and combinations of timber and concrete designs. The committee therefore reports progress and recommends continuing this subject for the following year.

DEVELOPMENTS IN PRACTICE OF BALLAST DECK TRESTLES SINCE PREVIOUS REPORT.

No important developments have occurred since the filing of the committee's report in 1908. The oldest creosoted timber ballast deck trestles in service have not yet begun to fail, nor have other than very minor renewals been necessary, notwithstanding the fact that some structures have been in service 18 years. The consensus of opinion of railway officers having most extensive experience with this class of bridges indicates that the serviceable life will doubtless extend over a period of 20 or 25 years, depending on soil and climatic conditions. These officers are unanimous in conceding the advantages of these structures, while some consider the disadvantages unduly magnified, especially with reference to the difficulty of securing properly treated timbers. Two general designs of structures of this type continue prevalent, viz., the solid stringer-floor design and the open stringer-floor plank design. In certain districts where it is economical to use deep stringers with correspondingly long spans, the open stringer and floor-plank deck requires less material than the solid-stringer floor and possesses the advantage of less expensive renewal of bents should the deck outlive the substructure. Two of the largest users of ballast deck wooden trestles have changed their standards so as to provide for an open stringer and floor-plank deck in lieu of the solid stringer deck. Both these railways operate in districts where deep stringers are readily obtainable. In certain other districts it is impossible to obtain large timbers at a reasonable price and therefore it is imperative to use shallow stringers and short spans, thus making the solid-stringer floor economical. The next few years should determine with fair accuracy the actual length of life and the annual expense of maintenance of these structures.

While only a limited number of inquiries were sent out, the replies received indicate the cost of ballast deck wooden trestles to be from 40 to 50 per cent of that of reinforced concrete trestles, from which fact it would appear that the construction of reinforced concrete trestles might not be entirely justified in all cases. The committee therefore begs to recommend that for next year's work it will report on the relative merits of ballast deck wooden trestles as compared with reinforced concrete trestles, and at the same time be relieved from further work in connection with the subject at hand, since no important developments in practice of ballast deck wooden trestles are likely to occur within the next few years.

USE OF LAG SCREWS FOR FASTENING GUARD TIMBERS.

In July, 1914, the committee issued a circular to the various railroads making inquiry regarding the present practice of the use of lag screws in fastening guard timbers to ties on wooden and metal bridges. One hundred and five replies were received, but of this number, only 19 per cent had ever used lag screws for this purpose on wooden deck bridges and 16 per cent on steel bridges. Almost without exception, the roads or systems using them reported satisfactory results from their use. Generally, where objections were offered, the reason was assignable to a faulty application, such as boring the hole only a small distance or not boring at all; depending on driving the lag screws and expecting them to remain tight. Too small sizes and spacing at too great intervals was another reason, in the opinion of the committee.

On October 31, 1914, at a meeting of the committee in Chicago, the data obtained from the circular was discussed, and it was decided to continue the investigation regarding the use of lag screws. Another circular was prepared and submitted to the various railroads throughout the country on January 2, 1915.

Seventy-five replies were received in answer to this second circular. Thirty-three roads replied they had never used lag screws at all for the purpose named, 13 had used them with success, 3 had used them without success, and 21 did not state definitely what experience they have had with them. Thirty-eight of the replies indicated that the subject was worthy of a trial, 9 stated it was not worthy, and 25 did not express any opinion on the matter. Thirty-three expressed their willingness to give them a trial upon the recommendation of the committee, 10 were doubtful, and 15 stated they would not make further trial.

The committee now recommends and urges that a further trial be made of the use of lag screws to fasten guard timbers to ties on wooden and steel bridges by such roads as have signified their willingness to give them a further trial.

The committee would recommend in this test that ties and guard timbers be sized one dimension at the mill and that the dapping of ties and guard timbers be omitted; that alternate ties be fastened to the stringers, and a lag screw be used to fasten the guard timber to each tie. Holes should be bored full depth and lags screwed into place.

The committee recommends that this subject be continued.

E. A. Frink (S. A. L.), chairman; W. H. Hoyt (D. M. & N.), vice-chairman; H. Austill, Jr. (M. & O.), J. E. Barrett (L. & H.), H. C. Brown, Jr. (I. C.), E. A. Hadley (M. P.), F. G. Hoskins (B. & O.), H. S. Jacoby (Cornell Univ.), A. O. Ridgway (D. & R. G.), I. L. Simmons (C. R. I. & P.), D. W. Smith (H. V.), W. F. Steffens (N. Y. C.).

Discussion on Wooden Bridges and Trestles.

The report was presented by Chairman Frink.

The first subject was adopted to be printed in the Manual.

The second subject was accepted as a progress report and the subject was continued.

Chairman Frink: We find that no developments have been made in the design of ballast deck trestles. They are still of the two principle types, the solid floor structure, made of stringers, packed tight against each other, and what you might call the open floor structure, with stringers separated and floored over with plank. During the investigation we have developed information which leads us to think that it would be well to investigate the comparison of cost and the justification of the building of concrete trestles as compared with ballast decked trestles. With the permission of the Board of Direction the committee would like to pursue this inquiry along these lines during the following year.

The President: The Board of Direction will take cognizance of the report of the committee and it will be considered.

Chairman Frink: The fourth subject has been given more investigation and study during the year than any of the other subjects. We find the vast majority of the roads that have used lag screws report in favor of their use. It would appear that there is little benefit to be expected from adopting lag screws as against bolts; but one of the principal reasons for using lag screws is that combined with their use you do no dap over your guard rail or your ties.

The President: The report of the committee will be received as progress.

G. H. Gilbert (C., N. O. & T. P.): As I understand it the use of lag screws eliminates the cost of dapping. The Queen & Crescent has not within the last few years dapped the guard rail, but uses ⅝-in. bolts for each tie.

Chairman Frink: With the use of lag screws every tie is held in place and every fourth tie is held in place by drift bolting. If the road wishes to spike every tie to the stringer that will make them so much more secure, but in the experience of the last eight years that we have on the Seaboard, we never had a case of derailment on a trestle that bunched the ties.

Hunter McDonald: For the past twelve years on our line we have never dapped any guard timbers. We have applied them creosoted and sized, used lag screws, and we have never had a case of bunched ties, that I know of, in the case of a derailment.

The President: The report will be received as a progress report and the subject will be continued.

H. S. Jacoby (Cornell Univ.): I am unfamiliar with the reason which led the committee to recommend that the principles of pile driving, Paragraph 15, be omitted. There is a recommendation to omit the words, "the weight or," and to change the word "weight" to "size." It seems to me in view of the fact that we have concrete piles instead of timber piles, that we ought not to drop out that part of the principle which certainly must be recognized, that the weight of a hammer has some relation to the weight of the pile. I think without question that until in recent years the tendency was to use hammers which were too light; but now, with the increased use of concrete piles, we ought not to close our eyes to that important principle involved.

Chairman Frink: The reason that the committee made that change is as follows: Change the word "weight" of drop to drop, because we believed the drop automatically covered that, and we changed the "weight of pile" to "size of pile," because we thought it was a better way to determine the factor governing the length of the drop of the hammer.

J. R. W. Ambrose (Tor. Term.): This clause has become more or less of an axiom. If it is in order, I move its elimination entirely.

J. C. Nelson (S. A. L.): I wish to second Mr. Ambrose's motion to eliminate Paragraph 15. Another important feature is the character of the pile that you are driving. Our expe-

rience is that a pile of less weight, diameter or length, on certain classes of work, can be driven with much less drop of the hammer than another class. We use almost exclusively in our plain piles cypress, and we find that we can't drop a hammer anywhere nearly as high on a cypress pile as heart pine. Therefore, I think that clause ought to be eliminated entirely.

(The motion was carried and the other recommendations approved.)

GRADING OF LUMBER

The work this year has been devoted to an investigation of the grading rules of pine and hemlock lumber. The committee finds that the rules for northern pine and hemlock, which were adopted several years ago, are no longer standard. It has been found wholly impracticable to purchase lumber under the rules as they are at present printed in the Manual, and the committee is unanimously of the opinion that these rules should be rescinded. With the co-operation of the Northern Hemlock and Hardwood Manufacturers' Association, a new set of rules has been drawn up for hemlock, which the committee presents herewith for study and criticism during the coming year.

In addition to the work of the grading rules, the committee has considered the investigations which are being conducted for the purpose of more definitely standardizing the nomenclature of the southern pines. The committee has co-

H. VON SCHRENK,
Chairman Committee on Grading of Lumber.

operated with similar committees of the American Society for Testing Materials and manufacturers of yellow pine. It has been generally recognized for a number of years that the grading rules for southern yellow pine do not sufficiently define the quality of the wood. It has been generally acknowledge that there is no practical means for definitely distinguishing between longleaf pine, shortleaf pine, loblolly pine, etc., after timbers have once been manufactured from the trees. It is furthermore recognized that it makes little practical difference from what species of pine a structural timber is cut, so long as certain density requirements are met. With these considerations in view, a number of the pine manufacturing organizations and the United States government have been purposing revised rules for grading yellow pine timbers. These rules involve the omission of the terms "longleaf," "shortleaf," etc., and call all the pines "Southern pines." They then define the different grades of yellow pines according to density.

The committee also presented the three rules which have been suggested. It will probably be another year or so before the details concerning definite specifications can be worked out, but much active work is now being done by the Committee on the Grading of Timbers of the American Society for Testing Materials and the various manufacturing organizations interested.

We recommend that the present rules for white and Norway pine and hemlock, printed in the Supplement to the Manual, 1912, be rescinded. The committee suggests as subjects for investigation during the coming year:

(1) Further investigation of grading rules for white and Norway pines.

(2) The continuation of work on specifications for southern yellow pines, to be carried on in co-operation with the American Society for Testing Materials and other similar organizations.

(3) The formulating of specifications for timber to be treated, in co-operation with the Committee on Wood Preservation.

Dr. Hermann von Schrenk (Cons. Engr.), chairman; B. A. Wood (M. & O.), vice-chairman; W. McC. Bond (B. & O.), D. Fairchild (N. P.), A. J. Neafie (D. L. & W.), W. H. Norris (Me. C.), J. J. Taylor (K. C. S.).

APPENDIX A.

GRADING RULES FOR HEMLOCK LUMBER.

TO COVER HEMLOCK LUMBER PRODUCED IN WISCONSIN AND UPPER MICHIGAN.

General Instructions.

The principal objects to be sought in the formulation of these rules are to establish grades that will blend the slight characteristics incident to different localities in such a manner as to produce grades of equal quality and value, and so constructed as to be best adapted to the principal purposes for which hemlock lumber can be utilized.

1. The face side of the lumber is the side showing the best quality or appearance.

2. Defects in lumber should be distributed in proportion to the size of the piece. Long or wide pieces of the same grade may contain more and greater defects than shorter or narrower pieces. The same percentage should be observed in both long and short, wide and narrow.

3. Wane in lumber is a defect which cannot be described by rule with satisfaction, and therefore must be left to the judgment of the grader. The lowering of grade on the face side on account of wane should be governed by grade, width and defects in the piece.

4. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or mill work will prohibit an inspection for the adjustment of all claims, except with the consent of all parties interested.

5. Mixed width boards do not necessarily require as good edges as shiplap or dressed and matched stock of the same grade.

6. Planing mill work should be taken into consideration in all grades of dressed lumber, and its effect on a piece must be left largely to the judgment of the inspector.

7. The grade of partition shall be determined from its poorer side only, when the order specifies partition.

8. Lumber when worked shall be graded the same as the respective grades when in the rough.

9. Unless otherwise provided for, lumber worked two sides shall be graded from its better face; lumber worked one side shall be graded from its surfaced face.

Definitions of Defects.

Knots shall be classified as pin, small and large or coarse, as to size, and round or spike, as to form, and as sound, loose, encased, pith and rotton, as to quality.

A pin knot is sound and shall not exceed ½ in. in diameter.

A small knot is larger than a pin knot and shall not exceed 1½ in. in diameter.

A large or coarse knot is one of any size over 1½ in. in diameter.

A round knot is oval or circular in form.

A spike knot is one sawn in a lengthwise direction.

The mean or average diameter of knots shall be considered in applying and construing these rules.

A sound knot is one solid across its face; is as hard as the wood it is in, and is so fixed by growth or position that it will retain its place in the piece.

A loose knot is not firmly set, but still retains its place in the piece.

A pith knot is a sound knot with a pith hole not more than ¼ in. in diameter.

An encased knot is one surrounded wholly by bark or pitch.

A rotten knot is one not as hard as the wood it is in.

Pitch pockets are openings between the grain of the wood containing more or less pitch or bark, and shall be classified as small, standard and large pitch pockets.

A small pitch pocket is one not over ⅛ in. wide.

A standard pitch pocket is one not over ⅜ in. wide, or 3 in. in length.

A large pitch pocket is one over ⅜ in. wide, or over 3 in. in length.

A pitch pocket showing open on both sides of the piece ⅛ in. or more in width shall be considered the same as a knot-hole.

Wane is bark, or the lack of wood, from any cause, on edge.

White or bright sap shall not be considered a defect in any of the grades provided for and described in these rules, except where stipulated.

In hemlock will often be found streaks or patches of red or brown discolorations, sound and firm, the presence of which does not weaken the wood, nor detract seriously from its utility. Water stain should not be confused with rot, being firm and strong, while rot is soft and decayed wood.

STANDARD SIZES FOR HEMLOCK.

Rough Lumber.

Piece Stuff.—Standard lengths for rough piece stuff are 4, 6, 8, 9, 10, 12, 14, 16, 18, 20, 22 and 24 ft. Standard widths are 4, 6, 8, 10 and 12 in. The standard thickness is 1⅞ in.

Boards.—Standard lengths for rough boards are 4, 6, 8, 10, 12, 14, 16, 18 and 20 ft. Standard widths are 4, 6, 8, 10 and 12 in. The standard thickness is 15-16 in.

Dressed Lumber.

Piece Stuff.—Standard sizes for piece stuff S1S1E are: 1¾x3¾, 1¾x5¾, 1¾x7¾, 1¾x9¾, 1¾x11¾.

Boards.—The standard thickness for inch lumber S1S is ⅝-in.

Flooring, Ceiling, Shiplap, Drop Siding.—Standard widths are: 3¼, 5¼, 7¼, 9¼ and 11¼ in. face. Standard thickness is ⅝-in.

Estimated Weights of Hemlock Lumber.

Per M Feet, Shipping Dry.

3-in. plank rough	3,000
3-in. plank and 4x4 to 8x8 S1S1E	2,700
3-in. plank, S4S or D&M	2,500
4x10 to 12x12, rough	3,500
4x10 to 12x12, S1S1E	3,200
4x4 to 8x8, rough	3,000
Thick D & better, S1S	2,500
Thick D & better, S1S1E	2,200
2-in. piece stuff, S1S1E	2,200
2-in. piece stuff, rough or S1E	2,500
2-in. piece stuff, S4S or D&M	2,000
1-in. boards, rough	2,400
1-in. boards, S1S or S2S	2,000
1-in. clear and select, S1S	2,000
Shiplap, D&M or drop siding	1,800
1x6 well tubing beveled edges	1,800
Sheathing lath	1,500
Lath	500
32-in. lath	300

Grading Rules.

Thick D and Better.—1. Thick D and Better shall be 4 in. wide and wider, 1¼ in., 1½ in. and dimension thickness.

2. This grade shall have sound, square edges, and be of the grade of Inch D Stock and Better on the face side, and not below the grade of Inch No. 1 Common on the back of the piece.

Boards and Strips.—There are six grades made in Boards and strips: Inch clear and select, inch D stock, No. 1 common, No. 2 common, No. 3 common and No. 4 common.

Inch Clear and Select.—1. Inch clear and select should be 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent 8 ft. long.

2. This grade is especially adapted for interior finish and only the face, or best side, is expected to show, although some attention should be given to the back of the piece.

3. The face shall show no wane, but the back may show such an amount of wane or other defects as will not interfere with the use of the piece for finishing purposes.

4. No shake or season check shall be allowed on the face side, but a very little tight shake and checks that are not deep may appear on the back of the piece.

5. This grade will admit on the face side several tight pin knots not over ⅜-in. in diameter. In a 4 or 6 in., 12 ft. and longer piece, not more than three knots are admissible, and proportionately more in a wider piece.

6. A 10 or 12 in. piece, 12 ft. and longer, will not admit of more than three sound, firmly set knots, not to exceed ¾ in. in diameter. Narrower and shorter pieces will admit of fewer large knots, but not a combination of large knots and other defects.

7. Pieces 12 ft. and longer are admissible that will, with not more than 10 per cent of waste, produce two clear cuts each 4 ft. long or longer.

Inch D Stock.—1. Inch D stock shall consist of boards and strips below the grade of clear and select 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent 8 ft. long, and must be of a sound and water-tight character.

2. All knots must be sound and firmly set. Red knots must not exceed 1¼ in. in diameter, and spike knots must not exceed in length one-fourth the width of the piece. Black knots must not exceed ¾ in. in diameter, and must be specially well set.

3. A 6-in. strip 12 ft. long shall not contain more than three defects of the extreme sizes. A wider or longer piece may contain relatively more of these defects; and narrower and shorter pieces relatively less. The general appearance of the piece must be taken into consideration.

No shake shall be allowed in this grade, but slight season checks and water stain shall not be considered defects.

5. This grade shall be suitable for sound drop siding, ceiling and flooring, and shall have a smooth appearance, especially on the edges.

Inch No. 1 Common.—1. The grade of No. 1 Common in boards or strips includes stock of a generally sound character.

2. Some shake is admissible.

3. Numerous knots, whether red or black.

4. Some water stain of a firm character.

Inch No. 2 Common.—1. Boards or Strips will admit of considerable shake.

2. Black, unsound knots.

3. Two or three good-sized knot holes, or more of small ones.

4. Streaks, or patches of discoloration, showing partial decay.

5. This grade can be safely recommended for general building purposes.

Inch No. 3 Common.—1. The defects may consist of excessive shake.

2. Very coarse, unsound knots.

3. Some soft rot.

4. Some cross checks.

Inch No. 4 Common.—4 In. and Wider, 4 Ft. and Longer. This grade includes all serviceable lumber below the grade of No. 3.

Piece Stuff or Dimension.—1. The grade of No. 1 Dimension will admit of shake that will not materially affect the strength of the piece.

2. Also knots, either black or red, that are well located and fairly sound.

3. Or some slight cross checks or sound water stain.

4. This grade, while admitting the above defects, must at the same time retain the element of strength required for any building purposes.

1. The grade of No. 2 Dimension includes stock not good enough to be classed as No. 1, and the defects admissible are of the same general character as the defects found in No. 1, except that they are more pronounced.

2. Considerable shake, large unsound knots, loose knots, knotholes and cross checks are all admissible in this grade, but not a serious combination of these defects in any one piece.

The grade of Merchantable is a combination of No. 1 and No. 2, consisting of approximately 50 per cent of each.

1. The defects of No. 3 Dimension are excessive shake, numerous knotholes, coarse, rotten knots or considerable rot.

2. This grade can be recommended for cheap, light construction.

No. 4 Dimension, 2x4 and wider, 4 ft. and longer, includes all serviceable dimension below the grade of No. 3.

Discussion on Grading of Lumber.

The report was presented by Chairman Von Schrenk.

The recommendation that the present rules for white and Norway pine and hemlock be rescinded was adopted.

Chairman Von Schrenk: The committee presents Appendix A as information, Appendix B is an extremely important matter, and these rules are suggested for the grading of southern pine lumber.

The President: The action proposed will be approved and the rules will be received as tentative rules. The committee is excused with the thanks of the convention.

ELECTRICITY

The following work was assigned:

(1) Continue the study of the subject of clearances.

(2) Report on the effect of electrolytic action on metallic structures and the best means of preventing it.

(3) Continue the preparation of a standard specification for overhead transmission line crossings.

(4) Continue the study of electrolysis and insulation and its effect upon reinforced concrete structures.

(5) Report on maintenance organization with relation to track structures.

CLEARANCES.

The sub-committee has been working in conjunction with the joint committee of the American Railway Association,

American Railway Engineering Association and American Electrical Railway Association on the subject of Clearances, and has submitted the following report, which was accepted by your committee and the recommendations concurred in:

G. W. KITTREDGE,
Chairman Committee on Electricity.

In the report of this sub-committee to the Electricity committee, and in the Electricity committee's report to the Association for 1913, it was stated that sub-committee on Clearances proposed to continue the study, in conjunction with other associations, and to make a recommendation changing the clearance line on Diagram "A," modifying the limiting clearance line FE for rolling equipment, to give additional space for automatic train stops or other permanent way structures.

We have investigated this question during the year and compiled information received from 196 railroads as to existing conditions of rolling equipment encroachment within the space under consideration. One hundred and forty of these replies show no encroachment.

This information was laid before the Joint committee, and the following resolution was adopted:

"That the limiting clearance line for rolling equipment, as adopted by the American Railway Association, should be changed so that the points FE2½/15 and GE O/15 become FE 2½/6 and GE O/6."

TRANSMISSION LINES AND CROSSINGS.

There has recently been organized a standing "National Joint Committee on Overhead and Underground Line Construction" composed of representatives from 14 associations and companies as follows: American Railway Association, American Railway Engineering Association, Railway Signal Association, Association Railway Telegraph Superintendents, American Electric Railway Association, National Electric Light Association, American Institute of Electric Engineers, American Electric Railway Association, American Telephone & Telegraph Company, United States Bureau of Standards, Independent Telephone Association of America, Western Union Telegraph Company, Postal Telegraph Company and the National Fire Protection Association.

Sub-committees have been appointed on (1) Underground and Undergrade Crossings, (2) Crossings of Electric Wires Over Electric Railway Tracks, and (3) Crossings of Trolley Contact Wires.

The sub-committee on Transmission Lines and Crossings has been working through its representation on the National Joint Committee to the end that uniform action may be ob-

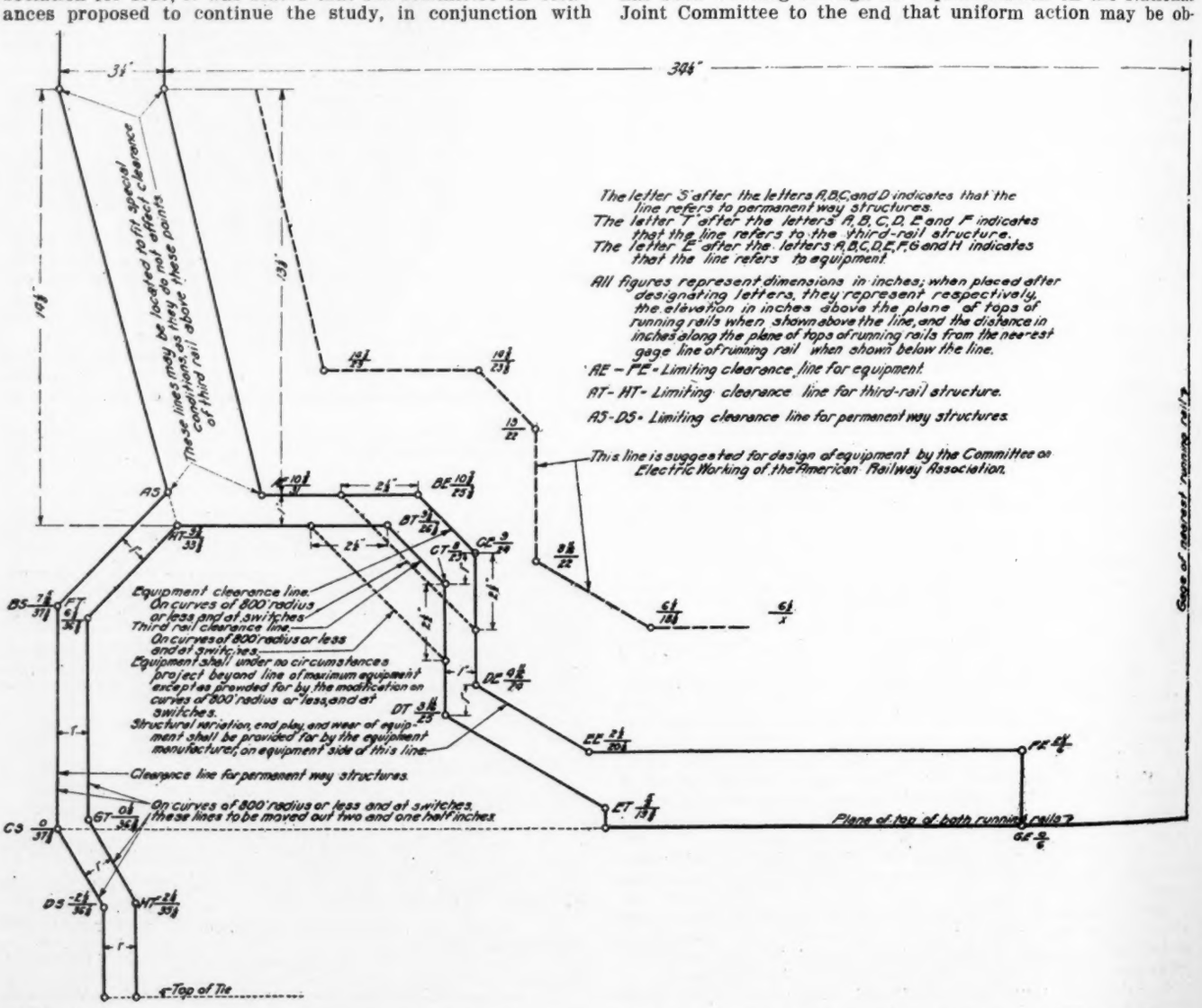

3½"
30½"
19½"
13'
The letter S after the letters A,B,C, and D indicates that the line refers to permanent way structures.
The letter T after the letters A, B, C, D, E and F indicates that the line refers to the third-rail structure.
The letter E after the letters A,B,C,D,E,F,G and H indicates that the line refers to equipment.
All figures represent dimensions in inches; when placed after designating letters, they represent respectively, the elevation in inches above the plane of tops of running rails when shown above the line, and the distance in inches along the plane of tops of running rails from the nearest gage line of running rail when shown below the line.
AE – FE – Limiting clearance line for equipment.
AT – HT – Limiting clearance line for third-rail structure.
AS – DS – Limiting clearance line for permanent way structures.
This line is suggested for design of equipment by the Committee on Electric Working of the American Railway Association.
These lines may be located to fit special conditions, as they do not affect clearance of third rail above these points.
Equipment clearance line. On curves of 800' radius or less and at switches.
Third rail clearance line. On curves of 800' radius or less and at switches.
Equipment shall under no circumstances project beyond line of maximum equipment except as provided for by the modification on curves of 800' radius or less, and at switches.
Structural variation, end play, and wear of equipment shall be provided for by the equipment manufacturer, on equipment side of this line.
Clearance line for permanent way structures.
On curves of 800' radius or less and at switches these lines to be moved out two and one half inches.
Gage of nearest running rail
Plane of top of both running rails
Top of Tie

Diagram A, Showing Recommended Clearance Line for Equipment and Structures Adjacent to Third Rail.

tained by all associations on the present, as well as all future specifications. It is the hope and intention to submit new specifications when and after their adoption by the National Joint Committee.

The sub-committee recommends the adoption, as a new specification, of the "Specification for Crossings of Wires or Cables of Telegraph, Telephone, Signal and Other Circuits of Similar Character Over Steam Railroad Rights-of-Way, Tracks, or Lines of Wires of the Same Classes." This specification has already been adopted by the Association of Railway Telegraph Superintendents, the American Railway Association, the Western Union Telegraph Co., the Postal Telegraph Co. and the American Telephone & Telegraph Co.

The sub-committee recommends the substitution of the revised edition of the "Specifications for Overhead Crossings of Electric Light and Power Lines," in place of that adopted in 1912. The changes, while rather numerous, are not of great moment, but since this revised edition has already been accepted by the American Electric Railway Engineering Association and the American Railway Association, it is advisable that uniform action be maintained.

The joint committee, as a whole, is working on the revision of the wire crossing specification.

RECOMMENDATIONS.

(1) The committee recommends for adoption by the Association and publication in the Manual Diagram "A," "Recommended Clearance Lines for Equipment and Permanent Way Structures Adjacent to Third Rail and for Third-Rail Structures."

(2) The adoption of the "Specification for Crossings of Wires and Cables of Telegraph, Telephone, Signal and Other Circuits of Similar Character Over Steam Railroad Rights-of-Way, Tracks, or Lines of Wires of the Same Classes."

(3) The adoption of the revised edition of the Specification for Overhead Crossings of Electric Light and Power Lines, with the understanding that the National Joint Committee will take up the question of the additions or changes in this specification previously suggested by this Association at its 1912 convention.

The committee recommends that representatives continue to serve on the National Joint Committee on Electrolysis and on the National Joint Committee on Overhead and Underground Line Construction.

It is also recommended that the statistical data furnished by the sub-committee on Clearance be added to from year to year and kept up to date, and that consideration be given any new information that may develop in reference to maintenance organization and relation to track structures, and asks for such other instructions as seem necessary or desirable.

George W. Kittredge (N. Y. C.), chairman; J. B. Austin, Jr. (L. I.), vice-chairman; D. J. Brumley (I. C.), R. D. Coombs (Cons. Engr.), A. O. Cunningham (Wabash), Walt Dennis (C. R. I. & P.), J. H. Davis (B. & O.), George Gibbs (Cons. Engr.), G. A. Harwood (N. Y. C.), E. B. Katte (N. Y. C.), C E. Lindsay (N. Y. C.), W. S. Murray (Cons. Engr.), W. L. Morse (Jacksonville Terminal), J. A. Peabody (C. & N. W.), Frank Rhea (I. C. C.), J. W. Reid (C. & A.), A. E. Robinson (A. T. & S. F.), J. R. Savage (L. I.), A. G. Shaver, Martin Schreiber (P S. R.), H. U. Wallace.

Discussion on Electricity.

The report was presented by E. B. Katte.

E. B. Katte: The report of the committee is largely one of progress. The first recommendation relates to the clearance diagram for third rail, and the committee recommends the adoption of the recommendation by the association for publication in the Manual.

The President: If there is no objection the recommendation will be published in the Manual.

E. B. Katte: The second recommendation is in a way new matter. It relates to specifications for crossings of wires and cables over steam railroad rights-of-way, etc.

J. C. Nelson (S. A. L.): Are these specifications for crossings those adopted recently adopted by the American Railway Association?

Mr. Katte: Yes.

The President: If there is no objection, this recommendation will be approved.

Mr. Katte: The third recommendation pertains to certain revisions and modifications in the existing specifications for overhead crossings of electric light and power lines, for overhead transmission line wires of higher voltages. They have already been approved by the American Railway Association, and by the American Electric Railway Engineering Association.

The President: There is a modification of the specification apparently contemplated in the future, and the chair would ask the committee as to the intent of its recommendation—is it intended to take the revised portion of the specification as submitted without change, and have that incorporated in the Manual, with the idea that it will be changed in the specification before it goes into the Manual?

E. B. Katte: The committee does not recommend this publication in the Manual.

The President: If there is no objection, this revised edition of the specifications will be approved. The other two recommendations will be referred to the Board of Direction, which will decide what is to be done in both cases. I hardly think they are subjects for the convention itself to pass on.

(The committee was excused.)

YARDS AND TERMINALS

The Board of Direction outlined the work for 1914 as follows:

(1) Report on typical situation plans of passenger stations, of both through and stub types, with critical analysis of working capacity, and include a review of the different methods of estimating their capacity.

E. B. TEMPLE,
Chairman Committee on Yards and Terminals.

(2) Report on developments in the handling of freight by mechanical means.

(3) Report on developments in the design and operation of hump yards.

(4) Continue study of track scales.

REVISION OF MANUAL.

Definitions.

COACH YARD—A yard in which passenger cars are assembled, separated or prepared for service.

INTERCHANGE TRACK—A designated track on which cars are delivered and received, as between railroads.

General Requirements of Yards and Terminals.

SCALE TRACKS—Scale tracks should be so located that weighing can be done with least delay and without drilling over same; where many cars are to be weighed they should pass separately over the scale by gravity, being weighed while in motion.

REPAIR TRACKS—These tracks should preferably be connected at both ends and have a maximum capacity of about 15 cars each, spaced alternately 16 ft. and 24 ft. center to center and be connected conveniently to bad-order tracks.

Hump Yards.

(2) T hump yard is a desirable form of yard for receiving, classifying and making up trains because a greater number of classifications can be made in less time and at less cost than through any other form of yard.

"(7) Rider track should, if possible, be provided through center of classification yard running to summit of hump, independent of other yard movements, thereby avoiding hazard of personal injury to car riders and reducing the number of car riders to a minimum."

Yard Lighting.

(1) For yard lighting the use of nitrogen lights of 1,500 watts capacity, equivalent to about 2,200 candlepower, is recommended.

TYPICAL SITUATION PLANS OF PASSENGER STATIONS.

The work of the Committee on this subject was devoted to a study of the newly-completed passenger terminal at Kansas City, Mo., and the methods of studying the capacity and train movements at this station were described.

DEVELOPMENTS IN THE HANDLING OF FREIGHT BY MECHANICAL MEANS.

The main work of the committee has been an inquiry as to improved methods which have been or might be introduced to increase the capacity, rapidity, or efficiency of the work, and to effect a reduction in its cost. This includes both hand trucks and motor trucks, the latter, of course, being one system of mechanical handling.

Two things appear to be evident: (1) More attention is being given to the efficiency of freight-house operation; (2) there is a growing opinion in favor of the use of motor trucks.

The question of improved methods and trucking at any particular freight house must be considered in relation to the other facilities and the local conditions. While the freight house should be of sufficient size for the handling of its tonnage, it should be compact to avoid unnecessary length of trucking. In general, for an outbound freight house, a short house with several tracks tends to economy and rapidity of work (as compared with a longer house and fewer tracks), since it reduces the length of trucking distance. For an inbound house, a wide house, giving plenty of floor space, tends to economy and rapidity of trucking, as it avoids the necessity of piling the freight high and allows quicker location of freight for delivery.

It has been suggested that new freight houses should be planned with a view to the eventual use of mechanical handling. But it is not easy to see how this can be done, except by providing a minimum of column supports which might be obstructions to motor trucks or conveyors. As noted later, clear space for movements is essential to good service with motor trucks.

In regard to mechanical conveyors for freight, it may be noted that the municipal wharf on the Missouri river at Kansas City, Mo., has a shed 300 by 40 ft., with two telpher tracks carried by the roof trusses and extending laterally through the building near each end. Along the front of the wharf is a track for an electric locomotive crane, which can take freight from the steamers or barges and deposit it at any point, or place it within reach of the telpher carriers.

This telpher equipment has not proved satisfactory and it is not believed that any such equipment could reduce the cost of handling the freight when it has been landed on the wharf in front of the doors of the warehouse. The house is narrow (40 ft.), with a continuous line of doors on both sides, and it is found simpler and cheaper to take the freight into the warehouse and across to the wagon side by hand trucking than by any form of telpher. In a warehouse of larger area and with packages of uniform size the telpher might be economical.

The equipment has been handled enough to thoroughly test it, but it is now used only when large and heavy pieces are moved from the wharf side of the warehouse directly through the house and loaded onto a wagon, as there is no crane equipment which will do this work. The equipment works satisfactorily, but it is thought that a lighter and speedier telpher would be used more frequently. The greatest cost in unloading barges and boats is in getting the freight from the boat onto the wharf, and this seems to be accomplished very easily by means of the locomotive crane. It is probable that an inclined chain package conveyor will be installed to handle small pieces and miscellaneous freight at this wharf.

The electric motor truck is increasing in favor and is of special advantage under proper conditions. As a freight carrier it is of use particularly where the commodities come in large lots, and where the freight house is so constructed as to give ample running room. A good and even floor is important also.

The electric freight trucks are adapted to the work at transfer houses as well as at ordinary freight houses. One point for consideration is as to their comparative advantages in freight houses where wagons deliver at a single doorway, and houses where they deliver at numerous doorways along the side of the house. Another point is that the increased speed of the trucking, with power trucks, tends to speed up the work of loading, unloading and stowing freight.

A particular point of interest in regard to these trucks is that some men consider them of most value when used as motor cars to haul trailer cars, rather than when operated as single independent units. This gives greater flexibility and facility of distribution. For the most efficient operation of motor trucks when thus used as tractors, it is necessary to have a sufficient equipment of four-wheel or six-wheel trucks to be used as trailers.

Some figures as to the cost of operation with electric trucks are given below.

A road operating 50 electric trucks states that an actual test by its electrical engineer indicates the following expense for maintenance and current consumption for these trucks

STATEMENT SHOWING COMPARISON OF OPERATING CONDITIONS IN ONE HUMP YARD AND TWO FLAT YARDS.

Month of August, 1914.

Questions Asked	Yard A (Hump) Eastbound hump-double track Westbound hump-double track	Yard B (Flat)	Yard C (Flat)
(1)—Percentage of south or east bound traffic	64½ per cent. loads 35½ per cent. empties	69 per cent. loads 31 per cent. empties	87 per cent. loads. 13 per cent. empties.
(2)—Percentage of north or west bound traffic	71 per cent. loaded 29 per cent. empties	55.8 per cent. loads. 44.2 percent.empties	65 per cent. loads. 35 per cent. empties.
(3)—Character of south or east bound loads	Fresh meat, live stock, live poultry, fruit, dairy and other food products, machinery, merchandise, grain, mill products, raw and finished coal and coke	Fresh meat, perishablemerchandise, grain, flour, stone, coal, coke, etc	Fruit, potatoes, sugar, vegetables, asphalt, cement, coal, flour, grain, hay, lumber, live stock, etc.
(4)—Character of north or west bound loads	Live stock, fruit, vegetables, merchandise, mill products, raw and finished machinery, coal, coke, limestone and ore	Perishable groceries, merchandise, lumber, slag, etc.	Automobiles, beer, furniture, machinery, fresh meat, merchandise, cement, coal, etc.
(5)—Number of loaded cars handled during the month	102,734 loaded cars (a)	96,903 loaded cars (b)	43,341 loaded cars (e)
(6)—Number of empty cars handled during the month	53,692 empty cars (a)	68,720 empty cars.	13,037 empty cars (e).
(7)—Number of cars weighed during the month	10,852 cars weighed	2,696 cars weighed	6,275 cars weighed.
(8)—Maximum number of cars handled during 24 hours	4,998 cars (3,962 over humps) (h)	2,976 cars (h)	1,537 cars (h).
(9)—Maximum number of cars handled during any one hour	632 cars	450 cars	316 cars.
(10)—Number of cars classified	211,760 cars (c)	79,081 cars	83,832 cars (e).
(11)—Cost per car	23.76c per car (d)	21.34c (d)	63.01c per car.
(12)—Rental of engines	$1.64 per hour (f)	$1.09 per hour (g)	$1.09 per hour (g).
(13)—Cost of air	$258.77	$4.51	$523.73.
(14)—Cost of lighting	$ 76.39	$97.08	$361.88.
(15)—Cost of supplies	$96.00	$33.45	$148.70.
(16)—No. of cars damaged	78 cars	60 cars	31 cars.
(17)—Cost of damage to cars	$1,854.50	$241.29	$359.50.
(18)—Are trains departing from yard made up in station order	With exception of 2 divisions set off trains are not made up in station order—all trains are made up to embrace districts affording the longest haul to the break up point	Yes	All trains are made up in station order, except drag trains which handle dead freight exclusively and empties.
(19)—Estimated cost of duplicating yard, exclusive of grading, bridges and buildings	$750,000.00	$329,200.00	$554,180.36

EXPLANATORY NOTES.

(a) These cars are counted only on entering the yard—cars departing from yard are not counted
(b) 53,737 loads entering and leaving yard; 43,166 loads switched to and from local industries; total, 96,903.
(c) Report showed 105,880 cars entering Yard A from either east or west, and were counted but once. For comparative purposes this amount was doubled, as cars switched in Yard B were counted on entering as well as leaving the yard.
(d) These figures include cost of yardmasters and assistants, switchmen, towermen, clerks, car riders, car inspectors, switch tenders, weigh masters, engineers, firemen, engine rental, cost of supplies, including power, air, light, heat, etc. General office or administration expense not included.
(e) Cars are counted entering as well as leaving yard.
(f) At Yard A the cost of engine rental is made up as follows:

Cost per 100 locomotive miles run for repairs of locomotives, including replaced locomotives	$18.29
Cost per 100 locomotive miles run for fuel yard locomotives	5.26
Cost per 100 locomotive miles run for lubricants for locomotives (yard and road)	.29
Cost per 100 locomotive miles run for other supplies for locomotives (yard and road)	.40
Cost per 100 locomotive miles run for engine-house expenses (yard and road)	3.07
Total cost per 100 locomotive miles run	$27.31
Average per mile	2731
Average per hour, based on 6 miles per hour for yard engines	1.64

(g) Cost of engine rental at Yard B was figured at $5.00 per day, and Yard C at $24.00 per 24 hours.
For comparison purposes committee figured it as follows:

Cost per 100 locomotive miles run for repairs to locomotives including replaced locomotives	$18.29
Average per mile	1829

Figuring 6 miles per hour for yard engines makes the cost 1.09 per hour as shown.
Fuel, lubricants, other supplies and engine house expenses are not included in engine rental, as they have been included in general expense.
(h) These cars counted but once.

NOTE—The comparatively high cost of handling cars in Yard "C" is accounted for by the fact that wages paid in Yard "C" are higher than in Yard "B."
Also due to the fact that extra expense, was incurred in Yard "C" handling cars to and from other railways and the stock yards.

Comparison of Yard Operation

working in the aggregate 48,000 hours in an approximate period of 12 months:

Labor and material	$3,630.90
Cost of current, 48,000 hours at 3.3 cents per hour	1,613.70
Cost per truck	104.89
Cost per truck per month	8.74

A report by the same road on the operating cost for handling freight with electric trucks, as compared with hand-truck operation, is as follows:

	Tons Handled by Electric Trucks.	Electric Trucks (Cts. per ton).	Hand Trucks (Cts. per ton).
Eastbound.			
Vessel to dock	24,050	19.25	29.23
Dock to car	12,383	11.38	13.15
		30.61	42.38
Westbound.			
Car to vessel	2,452	21.15	30.30

The 50 trucks were not in operation during all the working hours of the 12-month period. In addition to this, labor trouble was experienced at this point during this time, which compelled the employment of labor unfamiliar with the work. It is evident that if the work had been done under more favorable conditions, the cost per ton would have been reduced further.

The costs shown above include only the expense of foremen, truck operators and laborers. The figures show also the tonnage handled at these costs during October, November and December, 1912. On account of the short period the electric trucks were in operation and the small amount of tonnage handled, it is considered that it would not be fair to the electric truck operation to include all the items of expense incurred at the time of their installation and during their brief use at this point as a basis for the average cost per ton of handling freight.

The electric trucks were transferred to a transfer station in February, 1914, and the average results, based on the first seven months' operation (February-August, inclusive), are as follows:

	Average per Month.
Maintenance and repairs, including labor and material	$ 480.71
Cost of current	487.99
Labor expense, including foremen, checkers, truck operators, freight handlers, sealers and coopers	5,496.58
Interest on investment and depreciation of property	778.13
Total average expense per month	$7,243.41
Average number of tons handled per month	17,010 tons
Average cost per ton	42.58c
Average number trucks in use per month	47

In regard to electric trucks, the committee has the following statement from C. E. Taylor, secretary of the Local Freight Agents' Association of Chicago:

"All of the lines entering Chicago are still trucking freight by hand with the exception of the Chicago & Eastern Illinois and the Chicago, Burlington & Quincy. The former has three electric motors in use in the outbound house at Clark and Twelfth streets. The latter has seven electric motors in use in the outbound house at Harrison and Canal streets. Both lines are using these motors with trailers for trucking a large percentage of the l. c. l. freight which they handle at Chicago, but they als handle considerable quantities of freight with hand trucks. Each of these lines has demonstrated that the electric motors when used with a sufficient number of trailers, and when used in houses or on platforms which are adapted to their use, will result in a decrease in the cost of trucking freight as compared with the expense incurred in trucking exclusively by hand.

"It is generally conceded by freight agents who have given the subject much thought that the greatest benefit from electric motors as a means of trucking freight will be secured, not from the loading of freight on the motor, but by using the motor as a locomotive to pull trains of trailers. Under favorable conditions one of these motors can pull from six to ten four-wheel or six-wheel trucks heavily loaded, and by using the motors in this manner a very satisfactory decrease in average cost per ton for trucking freight can be secured."

DEVELOPMENTS IN THE DESIGN AND OPERATION OF HUMP YARDS.

Former reports have dealt more directly with the design of hump yards. This year it was thought desirable to obtain data covering the operation of a typical hump yard, as compared with a typical flat yard, preferably with a similar character of traffic.

One hump yard and two flat yards were selected for purposes of comparison. In the report the hump yard is referred to as "Yard A," and the flat yards as "Yards B and C." Statements were attached showing a comparison of the various features of the three yards. The figures were for the month of August, 1914, and represent the actual operating conditions and costs for each of these yards.

At yard A cars were counted only on entering yard. Cars leaving yard were not counted. At yards B and C cars were counted entering, as well as leaving the yard. On this account 211,760 cars are shown as handled in yard A at a cost of 23.76 per car, instead of 105,880 cars (actual) at a cost of 47.43 cents per car.

The committee thought it desirable to show cost of switching each cut of cars, as well as each car. The value of this information is apparent in making comparisons between two yards, as one road might average two cars per cut, and another road five cars per cut.

It was also thought desirable to itemize the cost per car for salaries of yardmasters, assistants, engineers, firemen, switchmen, towermen, clerks, car riders, car inspectors, switchtenders, weighmasters, etc., as well as cost of supplies, power, air, light, heat, etc., the total cost of each item per car to equal the total cost of switching per car. The cost of switching per cut of cars is shown for Yard A.

In this report, however, the committee was unable to distribute each item of expense on a car basis, but hopes to be able to do this in the future, as well as to show the cost of switching each cut of cars.

This year the committee also considered typical plans of turnouts on ladders. A member of the committee submitted plans of different track layouts over humps and ladders. The subject will be carried over and a further study made next year.

The committee suggests that the engine employed on the approach to the hump be of sufficient power to handle from a start the maximum train received in the yard.

TRACK SCALES.

Progress has been made on this subject, and the committee has under consideration the report adopted by the American Railway Association in 1913. A few important changes and several minor ones have been suggested. It is the desire of the committee, before making final recommendations on this subject, a very careful and full discussion shall be indulged in, and, with the approval of the Board of Direction, this committee will confer with the proper committee of the American Railway Association on an approved set of track scale specifications and rules.

SUGGESTIONS FOR NEXT YEAR'S WORK.

(1) Continue study of typical situation plans of passenger stations and approaches and methods of operating same.

(2) Report on handling of freight in double-deck freight houses, with cost of operation.

(3) Continue study of classification yards:

(a) Unit costs of operation of typical hump and flat yards.

(b) Yard lighting.

(c) Power vs. hand-operated switches in hump yards —advantages and disadvantages.

(4) Continue study, and, if possible, make report on track scales.

E. B. Temple, chairman (P. R. R.); B. H. Mann, vice-chairman (M. P.); W. G. Arn (I. C.), H. Baldwin (C. C. C. & St. L.), G. H. Burgess (D. & H.), A. E. Clift (I. C.), L G. Curtis (B. & O.), H. T. Douglas, Jr. (C. & A.), A. C. Everham (K. C. T.), R. Ferriday (C. C. C. & St. L.), G. H. Herrold, D. B. Johnston (P. L. W.), H. A. Lane (B. & O.), L. J. McIntyre (H. P.), A. Montzheimer (E. S. & E.), H. J. Pfeifer (T. R. R. or ST. L.), S. S. Roberts (Cons. Eng.), W. L. Seddon (S. A. L.), C. H. Spencer (I. C. C.), E. E. R. Tratman (Engineering News), E. P. Weatherly (K. C. T.), W. L. Webb (C. M. & St. P.), C. C. Wentworth (N. & W.), J. G. Wishart (C. R. I. & P.).

Discussion on Yards and Terminals.

The report was presented by B. H. Mann, vice-chairman. The reports on "typical situation plans of passenger stations," "developments in the handling of freight by mechanical means," and "developments in the design and operation of hump yards" were received as information and the report on track scales was referred to the Board of Direction.

The revision of the Manual was then taken up, changes being made in the following items:

C. Dougherty: With regard to the definition of an interchange track, will the committee make that "delivered or received"? The committee accepted the suggestion.

C. E. Lindsay: With respect to scale tracks, I suggest that in the second line it read, "drilling over scale."

B. H. Mann: The committee will accept that.

C. E. Lindsay: I repeat a request for the committee to study the subject of poling yards.

The President: That will be referred to the Board of Direction.

REGISTRATION—AMERICAN RAILWAY ENGINEERING ASSOCIATION

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von Schrenk, Hermann, Dr., Con. Timber Eng., St. Louis, Mo.
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O'Connor, John A.
Olson, O. M.
Reasoner, Mark H., Asst. Supv. Stations, M. St. P. & S. S. M. Ry., Minneapolis, Minn.
Spieth, O. C., Asst. Div. Eng., Baltimore & Ohio R. R., Cleveland, O.
Sloan, E. D., Valuation Engr., Nashville, Chattanooga & St. Louis Ry., Nashville, Tenn.
Shaver, W. E.
Swartwout, W. B., Contracting, Milwaukee, Wis.
Thomson, W. B., Val. Eng., Wheeling & Lake Erie R. R., Cleveland, O.
Thorp, J. N., Jr., Eng. of Tests, Erie R. R., Jersey City, N. J.
Worley, John S., Member Engineering Board, Interstate Commerce Commission, Kansas City, Mo.
Wait, B. A., Asst. Engr., Chicago, Rock Island & Pacific Ry., Estherville, Iowa.

CHICAGO & NORTH WESTERN ROADMASTERS' MEETING

A meeting of the roadmasters of the Chicago & North Western—one of their regular meetings—was held yesterday at the general offices. A number of questions relating to track maintenance were reported on and discussed. The time of meeting and the location made it possible for the roadmasters to attend the convention and exhibit. In the past it has been customary for the assistant general manager to act as chairman of this meeting, but in this case one of the roadmasters was elected temporary chairman. The gathering took the form of an experience meeting, and labor problems, spring and summer work and other maintenance topics were discussed.

HIGHWAY CROSSING SIGNALS WITH MOVING ARMS AND LIGHTS

Many of the visitors at the exhibit commented on the large number of highway crossing signals with moving lights or moving arms which were exhibited this year. In all, there were 48 highway crossing signals shown by six companies, of which 18 had either moving arms, moving lights or both. The rest of the signals were standard types with crossing bells. This is a large increase in the number of these signals over any previous year.

RESOLUTIONS

The following resolutions were adopted in the closing business session of the convention yesterday afternoon:

Resolved, That the Board of Direction be requested to consider a working plan by which the conclusions of certain other associations working along the same lines of research as ours may receive the endorsement of this association without discussion in detail by its conventions.

Resolved, By the members of the American Railway Engineering Association, in convention assembled, that we desire to place on record our appreciation and extend our hearty thanks to Mr. Charles S. Gleed, Sir George Foster, Mr. Frank L. Mulholland and Mr. Benj. Baum, for their admirable and instructive addresses at the annual dinner; to the National Railway Appliances Association for the instructive and comprehensive exhibit of devices used in the construction, maintenance and operation of railways; to the technical press for the daily reports of the convention and useful information made available to the members; to the official reporters, Messrs. T. E. Crossman and G. W. Burgoyne, for their accurate and painstaking reports of this and previous conventions; to the tellers for their arduous labors in counting and tabulating the ballots for officers for the ensuing year, and to committee No. "23" on arrangements, for the highly successful arrangements made for the comfort and entertainment of the members and guests attending this convention.

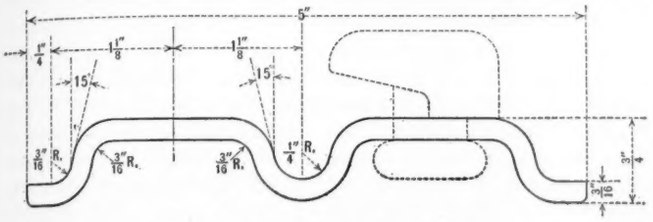
A LIGHT STEEL TIE

A steel tie designed for mine and industrial railroads and for light construction tracks has recently been placed on the market by the Cambria Steel Company, Johnstown, Pa. This tie is a rolled steel section, illustrated in the accompanying drawing, which is calculated to combine light weight with sufficient strength. The section illustrated, which is intended to carry 40 to 60 lb. rails, is 5 in. wide, ¾ in. deep and weighs 4 lb. per lin. ft. Two lighter sizes are also made, one for 16 to 45-lb. rail, which is 4 in. wide, ½-in. deep and weighs 2.16 lb. per ft., and one for 12 to 20-lb. rail, which is 2¼ in. wide, ½-in. deep and weighs 1.12 lb. per ft. The ties can be furnished for all gages from 30 to 54 in.

The rails are attached by flanged buttons permanently connected to the ties. These buttons are adjusted before shipment so that the friction will hold them in any position to which they may be turned. Solid wrenches are furnished for turning these fastening buttons in laying or removing rails, although ordinary adjustable or solid wrenches can be used equally well. A quarter turn with the wrench clamps each button on the rail, eliminating the driving of spikes and the adjustment of nuts. The fixed position of the button on the tie also automatically gages the rail. The fact that these

buttons are attached permanently to the tie avoids the possibility of loose or missing parts.

The light weight of these ties makes it possible to shift sections of track easily. A medium weight tie for 36-in. gage with fastenings complete will weigh about 10 lb., and short sections of track laid with such ties can be rapidly assembled and transferred, effecting a considerable saving in time for temporary light track work. The life of these steel

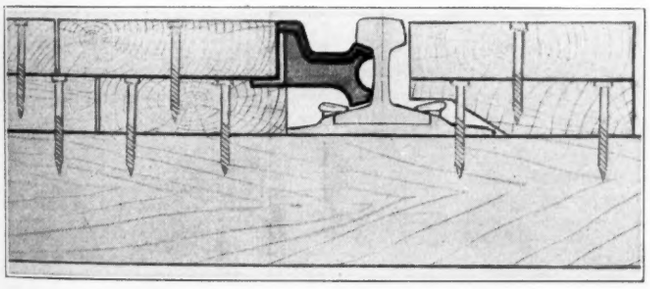


Section of the Slick Steel Tie.

ties depends largely, of course, on the conditions under which they are used, but in any event is doubtless greater than that of a wooden tie. The life of the ties may be further increased by a treatment with coal tar, asphaltum or similar coating applied by dipping the tie and fastening. The company is prepared to furnish ties so coated if desired.

A FLANGEWAY GUARD OF IMPROVED DESIGN

The Newhall flangeway guard, which is manufactured by the Cleveland Railway Supply Company, Cleveland, Ohio, is now being tested on a number of roads. This guard is so designed that when in place one side fits against the crossing plank or the pavement and the other side under the head of the running rail. It is held in position by the rail and the



Cross Section of Newhall Flangeway Guard with Planks.

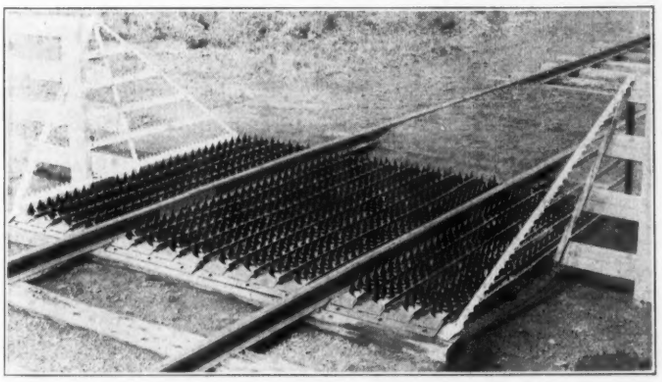
plank or pavement, no bolts or spikes being required. This rail is made of malleable iron in 4-ft. sections, which are securely interlocked. The flangeway provides the standard vertical clearance and the minimum longitudinal clearance necessary to avoid guard-rail action when the gage of track is ½ in. wide. The guard will not wear to a sharp edge, which is likely to cut automobile tires, nor can a horse's hoof be caught in it. The illustration herewith shows the general design and method of installation.

MASTER TRACK GAGE AND LEVEL

A new gage combining in one a standard track gage and level and a master gage for testing foremen's gages has recently been put on the market for the convenience of engineers, roadmasters and supervisors in checking up the gages of their men. This gage is made of seasoned hard maple finished in the natural color with brass caps on the ends forming the contact points. The standard gage includes a guard rail attachment and a graduated scale for measuring wide gage on curves and on the uppper side of the instrument are located the master gage and the level with adjustable bulbs and elevation slides. This device is manufactured by the Kalamazoo Railway Supply Company, Kalamazoo, Mich.

IMPROVED SURFACE CATTLE GUARD

The National Surface Guard Company, Chicago, manufactures a metal surface guard with high points punched from heavy plate, making it unusually severe on stock attempting to cross it and strong enough to prevent bending under the weight of an animal. This guard, shown in the accompanying illustration, is made of a high grade of open hearth steel, which is given a heavy coating of oil asphaltum paint. On account of the treatment given the metal and the ample

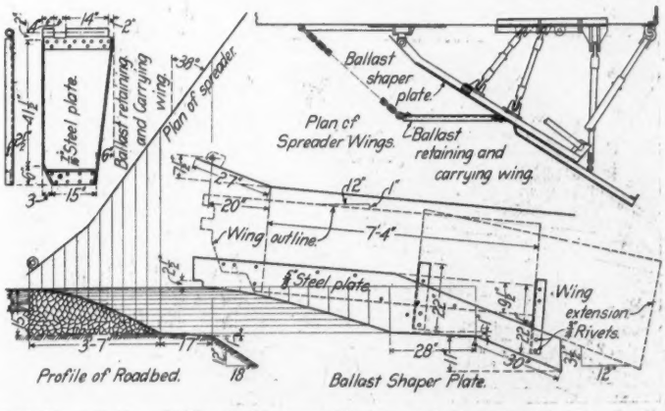


An Installation of the No. 10 National Surface Guard.

provision for drainage the liability to corrosion is greatly decreased. The points are approximately 2½ in. high and are assembled by so-called "thimbles," which raise the guard 2½ in. above the tie, forming a slight pit. In addition, it is recommended that one-half of the ballast be removed directly under the guard before its installation to provide a certain amount of oscillation under a load, considerably increasing its effectiveness.

SPECIAL WING FOR MANN-McCANN SPREADER

An attachment designed to spread the ballast to the standard roadbed section of the Chicago, Milwaukee & St. Paul has been developed and applied to a Mann-McCann ballast spreader in use on this company's lines in Montana. By the use of this wing the gravel ballast unloaded along the track has been spread and properly shaped at the rate of one mile in 20 minutes. This wing is also equipped with a ballast retaining and carrying wing with a capacity of 2½ cu. yd., which picks up the excess ballast and automatically feeds it out under its lower edge at points where there is an insufficient quantity. Such points are ordinarily



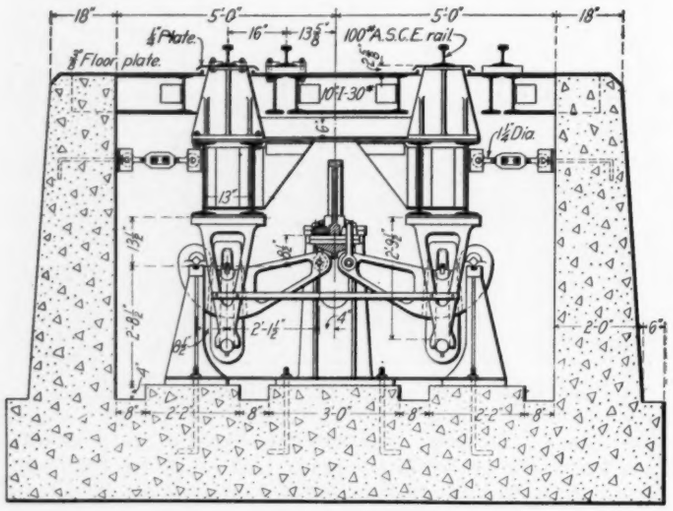
Details of the Ballast Shaper Plate and the Retaining and Carrying Wing Used with the Mann-McCann Spreader on the C. M. & St. P.

found at regular intervals corresponding to the spaces between the cars from which the ballast was dumped. This spreading wing is operated by compressed air in the same manner as the other side and center spreaders on this

machine, allowing it to be folded or unfolded almost instantaneously. This spreader is manufactured by the Mann-McCann Company, Chicago.

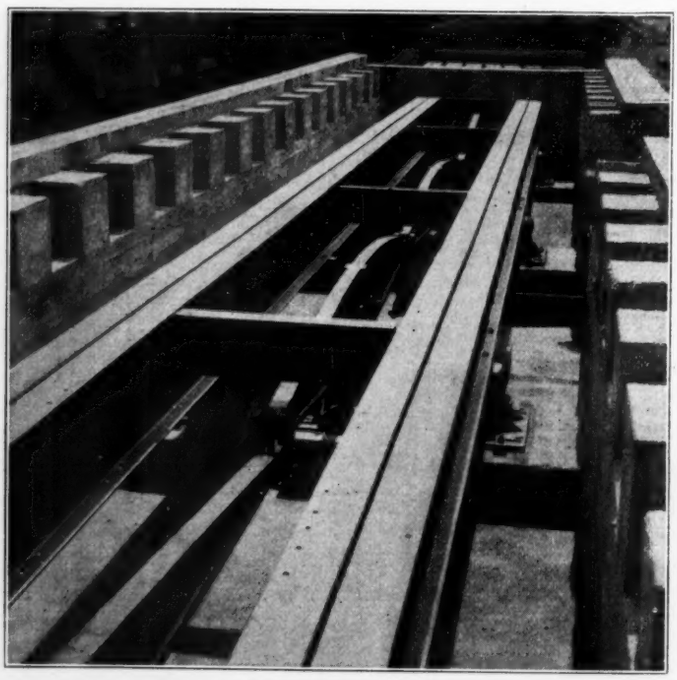
A SUSPENSION-BEARING CENTER-CONNECTED TRACK SCALE

A new single-link center-connected suspension-bearing railroad track scale has recently been designed by the Buffalo Scale Company, Buffalo, N. Y., and several successful in-



A Typical Cross-Section Through the Pit of the Suspension Bearing Track Scale, Showing the Details of the Main Lever Bearing.

stallations of the design have been made. The noteworthy feature of this design is in the bearing by which the load on the platform is transferred to the main levers. The main levers resting on chairs and the load is suspended from them



One of the Recent Installations of the New Suspension Bearing Center Connected Track Scales.

by a bearing consisting of only five parts. The platform girders bear directly on a steel yoke spanning the main lever and extending down to 24 to 28 in. below the bearing point on the upper surface of this lever. The sides of the yoke rest on the ends of a steel pin which extends through a heavy square-topped steel link passing up through a vertical slot in the main lever and over the heavy bearing block resting on the pivot on the upper edge of the main lever. In a four-section scale the load is carried by eight of these bearings, permitting free oscillation of the platform in all directions. In addition to this, the scale has a center connection which eliminates the use of an equalizer or rocker bar and adapts itself to any spring or slight irregularities in the platform girders.

The arrangements of levers conforms to the type of construction previously used by this company. The cross lever is furnished in 9-ft. or 10-ft. lengths and pivots wherever possible are heavily reinforced by the lever casting. The suspension links are made long to allow free, easy motion of the weighing platform in order to absorb thrust and impact in a transverse as well as a longitudinal direction and to avoid friction of the platform. These links are made of annealed cast steel. The chairs are of gray iron, the yoke of annealed cast steel and the yoke pins, which are 3½ in. in diameter, are made of steel with an ultimate strength of 84,000 lb. per sq. in. All metal exposed to moisture, with the exception of the bearing surfaces and the weigh beam, is coated with rust-resisting material and all parts are arranged for easy access for inspection and cleaning.

THE CONCRETE ATOMIZER

A new process of mixing and placing concrete in which the materials are heated to a high temperature after mixing in order to increase the hydration of the cement has been used with satisfaction on the Delaware, Lackawanna & Western and several other roads during the past two years. The quality of the concrete is said to be greatly improved by the application of heat and pressure as used in this system, the density being increased from about 137 lb. to 170 lb. per cu. ft., which is greater than granite, and the strength increased to three or four times that of average concrete. Microphotographs have disclosed no holes or cracks in this material, and one chemist who examined a specimen reported that no trace of unhydrated cement could be found.

The apparatus used for mixing and curing the concrete is known as a concrete atomizer. The process is described by the inventor, Harold P. Brown, 120 Liberty street, New York City, as consisting of thoroughly mixing measured amounts of cement, sand, broken stone and water in a cylinder, which is then filled with a hot gas or vapor under high pressure, the plastic concrete being then dropped into a superheated stream of rapidly moving gas or vapor, which separates the particles from each other and carries them in a rubber-lined hose to the point of deposit, projecting the stream against the work at high speed through an expansible nozzle. The blow struck by the material tamps it thoroughly and also jars out a portion of the water, the high temperature and the sudden reduction of pressure causing rapid evaporation of the remaining moisture so that quick setting is obtained. The process of building up the concrete on the surface of a wall or form by the deposit first of a layer of cement and then the imbedding in the cement of the particles of sand and later of the larger particles of crushed stone is similar to that which has been made familiar by the use of the cement gun, although the atomizer process differs from that of the gun in the use of crushed stone. The two processes also differ, of course, in the use of a preliminary mechanical mixing and the application of heat in the atomizer.

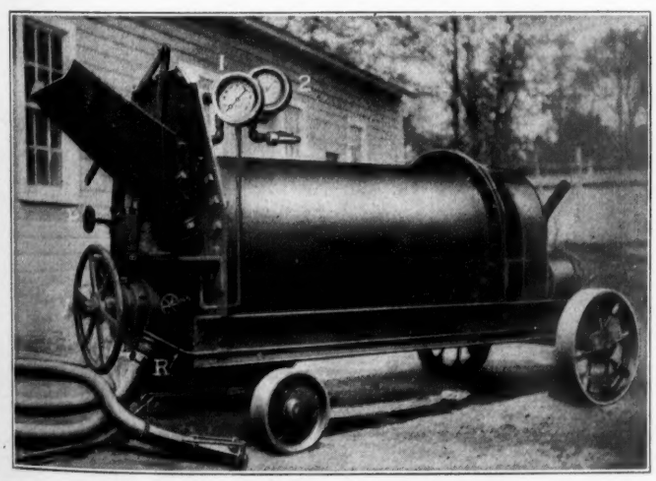
The No. 2 atomizer consists of a mixing cylinder with a charging door either at one end or in a dome on the top and containing a central driving shaft of square section which carries a series of mixing paddles and scraping devices for keeping the inner surface of the cylinder clear.

The necessary connections and valves for admitting steam to the cylinder and the discharge opening connecting with a 1¾-in. hose are located at one end of the cylinder. The mixing paddles are driven by a steam engine, the speed of which automatically increases as the load decreases during the discharge of the material, so that the rate of discharge can be kept uniform. When the cylinder is nearly empty the steam supply is shut off, the remainder of the work being performed by the expansion of the steam through the hose. The piston of the outlet valve is made to clear all material from its path when closing, so that the concrete cannot set in the pipe.

The No. 3 atomizer is similar in construction, having a mixing tank 5 ft. long and 3 ft. in inside diameter. It is designed to mix about 20 cu. ft. of loose materials at one batch and has a rated capacity of 150 to 180 cu. ft. of concrete per hour. This machine is designed to handle crushed stone up to 1 in. in size. An engine of special design is used to operate this machine, as the service requirements are unusual. This engine has a splash lubrication system and is self-contained. It can be operated with compressed air when the machine is used in tunnels or caissons and in this case the air can, if necessary, be superheated, giving the combined advantages of heat and pressure.

A special grade of rubber is used for lining the hose through which the concrete is placed, and it has been found that this hose is worn very slightly, since the wet cement lubricates the surface as soon as the stream is turned through it. Several lengths of this hose which have been in service for more than a year are said to show very little wear. Special couplings are used which have no metal parts exposed to the concrete. As an ordinary conical nozzle would be clogged frequently by stones, an expansible rubber nozzle was designed, the size of which is controlled by a lever in the hand of the operator. In case a pebble blocks the flow a slight movement of this lever opens the passage to the full diameter of the hose, allowing the obstruction to be blown out. The pressure at the nozzle is about 45 lb.

The concrete atomizer can be operated with one man at



The No. 2 Concrete Atomizer.

the nozzle, one at the machine and two or three laborers for handling the material. The accompanying photograph, illustrating its use on the Lackawanna retaining walls, shows two men at the nozzle, the duty of the second man being simply to keep a lookout for the flagmen who signaled the approach of trains. About 250 cu. ft. of fre air per minute at 40 to 50 lb. pressure is required when the machine is operated at full capacity on compressed air, and when steam is used the mixing is done at a pressure of 75 to 80 lb., with sufficient superheat to prevent condensation. By increasing the amount of superheat to the proper degree, the steam issuing from the nozzle is kept in gaseous form so that the work deposited can easly be seen by the operator. This stream is kept flowing from the nozzle continuously during the work in order to keep the surface on which the concrete is being deposited warm enough to prevent unequal contraction during the setting of the concrete. When the boiler is operated at 180 to 200

Repairing Retaining Walls on the D. L. & W. with the Concrete Atomizer Taking Steam from the Work Train Engine.

lb. pressure, a reducing valve placed close to the machine and set for 85-lb. pressure can supply the mixer, thus obtaining the required superheat. For use along an operated line, a machine can be connected to the steam dome of a locomotive and all other auxiliary apparatus eliminated.

At one point at which the small atomizer has been used a 60-hp. boiler was used to supply steam for a compressor furnishing air for the atomizer, this boiler consuming about 400 lb. of No. 3 buckwheat coal per hour, using forced draft, the output of concrete amounting to about 1 cu. ft. per minute. When steam was used direct instead of air the same amount of work was accomplished with natural draft on the boiler and a consumption of less than 100 lb. of coal per hour. The cost of the fuel for mixing, pouring and placing 1 cu. yd. of concrete with the No. 2 machine has been not more than $0.10 and the cost of fuel and labor less than $0.80 per cu. yd. With the larger machine this cost is reduced to less than $0.50 per cu. yd.

One of the early uses of this machine was in coating more than 6,000 sq. ft, of structural steel with 2 to 6 in. of concrete in the Grand Central Terminal improvements in New York City. Both compressed air and steam were used in this work, all of which has proved to be unusually hard, and it is said that no cracks or faults have developed in it. The Lackawanna rented one of these machines for several months to repair defective and honeycombed concrete subject to tidewater at its Hoboken terminal. Compressed air was used in this work, but for the repair of retaining walls, such as that illustrated herewith, steam was taken directly from the locomotive of the work train. This road has recently purchased this apparatus for further repair and construction work.

A CASE OF EXCESSIVE RAIL CREEPING

A very unusual instance of rail creeping is reported by the M. W. Supply Company, Philadelphia, Pa., manufacturers of the Vaughan rail anchor. A section of track near

Goshen, N. Y., is laid over very soft marshy ground commonly known as "meadows." It has seemed almost impossiple to get a solid foundation for this track, as much as 30 ft. of filling material having been put in in some places without changing the elevation of the track. A train passing over this section produces waves in the rail and in the surface of the ground near the track which are plainly visible. As a natural result creeping is a very serious matter, the spikes being pulled out of the joint ties by the slots in the splices, the ties being split and the splice bolts very frequently being sheared. The rails at one point were marked and during one summer were found to have moved ahead more than 80 ft. This necessitated the frequent use of switch points and constant attention on the part of the section gang as the joints were constantly opening. The application of rail anchors to practically every tie on this section has very greatly reduced the amount of creeping but has not entirely stopped it as the anti-creepers are pushing the ties ahead with the rails. While as a general thing 14 to 18 in. of creepage a year is considered excessive this company states that from 4 to 6 in. a year makes the use of anti-creepers an economy.

The Millies Combination Rail Brace and Tie Plate and a Special Switch Point Brace and Plate.

BARRETT SPECIFICATION ROOFS, FLOORS AND PAINT

The Barrett Manufacturing Company, New York, has recently laid much stress upon a more systematic inspection of the laying of Barrett specification roofs. An inspection sheet is now made a part of the specification, which includes full directions as to identifying the correct materials when they are delivered on the job. It gives methods of ascertaining that the contractor has used these materials in the requisite amounts to comply with the specifications. It also includes methods approved by the National Association of Master Gravel and Slag Roofers of America for cutting a slit in the roof at right angles with the way the felt is laid so as to exhibit a cross-section of the roof.

Another interesting field of development has been in the formation of practices and the preparation of specifications for the use of tar in sub-floors where a wooden floor is required at the ground level or below. Sleepers and heavy timbers are dispensed with and the planking laid directly on the mixture while it is still soft. The mixture hardens to a tough, solid base, which affords effective protection against dampness. These "Tar-Rok Sub-Floors," as they are called, are a sufficient foundation for any self-contained machinery.

Other recent research work done by the Barrett company has been the development of "Hydronon," a damp-proofing paint adapted for use on interior surfaces of walls that are exposed to dampness. It will penetrate well into a wall of concrete or brick and will retain its effectiveness against considerable usage. Whitewash, cold-water paint, or plaster may be applied directly over this. It is less volatile than other paints made for this purpose and has a high flash point, removing the danger incident to those that involve a large proportion of benzine.

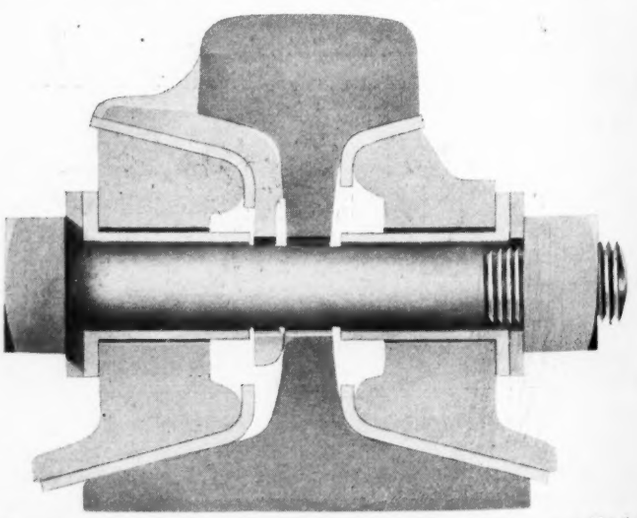
A COMBINED RAIL BRACE AND TIE PLATE

The Millies Railway Appliance Company, Hammond, Ind., has developed a combined rail brace and tie plate which has been on the market about one year and is in service on the Indiana Harbor Belt and several other roads. This device consists of a plate 6 in. wide, 11 in. long ½ in. thick under the outer edge of the rail base and ⅜-in. thick under the inner edge, with which is cast integrally a double-ribbed brace that can be made with a contour to fit any rail section. The details as to the size of plate, thickness and the use of ribs on the bottom surface can be varied to suit the requirements on different roads.

This device is made of malleable iron and weighs from 6 to 9½ lbs., depending upon the rail section with which it is used. By placing the inner spike holes slightly under the base of the rail the spikes serve to draw the brace firmly against the rail head. A special plate for use at switch points is shown at the right in the accompanying illustration. This plate is 9 n.i longer than the standard, this extension being raised ¼ in.

KEYSTONE INSULATED RAIL JOINTS

New features recently embodied in Keystone insulated rail joints are continuous divided insulation, bakelized fabric as a substitute for fiber, and heat-treated bolts. The insulating fiber is divided horizontally instead of vertically as heretofore, being continuous for the length of the rail joint. This makes all insulations the same size and interchangeable, and independent of the spacing of the bolts on all joints of a



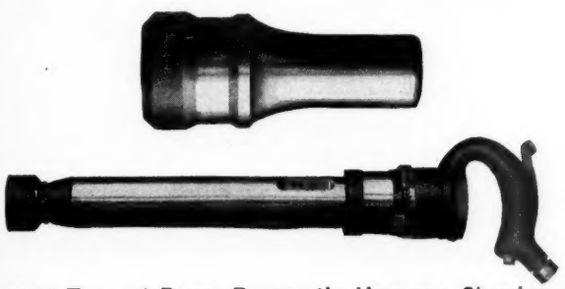
Keystone Insulated Joint with Improved Insulation and Heat-Treated Bolts.

given length, while providing a better insulation on account of being continuous. The insulation on the gage side of the joint under the head of the rail is bakelized fabric, the other three insulations being fiber. This new material has several times the wearing qualities of fiber and is impervious to moisture, maintaining its dielectric strength until it is worn out. The joints are equipped with bolts which have been given a special heat treatment, increasing their elastic limit over 40 per cent.

The Keystone insulated rail joint is manufactured and sold by the Union Switch & Signal Company, Swissvale, Pa.

AN IMPROVED PNEUMATIC HAMMER

The latest form of Boyer pneumatic hammer is the No. 11, illustrated herewith, which has just been placed on the market by the Chicago Pneumatic Tool Company, Chicago, Ill. It has a piston diameter of 1 3-16 in. with an 11-in. stroke, striking 700 blows per minute. It weighs 3½ lb. and is capable of



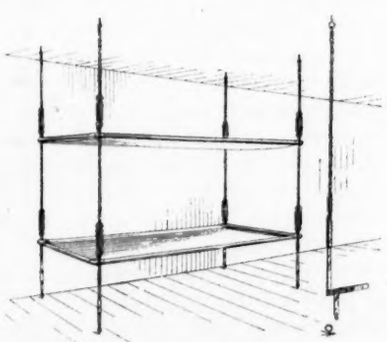
Improved Type of Boyer Pneumatic Hammer, Showing Also Parker Rivet Set.

driving 1½-in. rivets. Owing to the severe service required of the rivet sets in this hammer, the so-called Parker set is used, which has a wide tapering shoulder, enabling it to better absorb and withstand the effects of the blows.

In common with the standard form of the Boyer hammer, the No. 11 is divided into three distinct parts—handle, cylinder and valve—which allows quick examination and economical upkeep and repairs. In each of these members there is a moving part subject to wear, but in varying degrees. It is frequently possible to replace one of these parts and thereby render the tool comparatively new. All parts are made interchangeable on jigs and templates.

IMPROVEMENT IN THE GOSSO BED

An improvement has been made in the Gosso bed, since its appearance on the market a year ago as described in the *Railway Age Gazette*, of March 19, 1914, that will greatly



Improved Spring in Gosso Bed.

facilitate its installation in railway bunk cars and its removal when not in use. As originally installed there was some little difficulty experienced in expanding the small springs which are used to keep taut the perpendicular chains in which the beds are hung. There was also the possibility that an inexperienced workman might overstrain the small spring and "kill" it.

These beds are now equipped with an expander, which is opened until the chains are attached to the floor and the ceiling, when it is closed by a simple push and the small springs are stretched exactly one inch. This is sufficient to keep the chains taut and guards against the danger of overstraining the spring. When it is desired to take the beds down, the expander can be opened in an instant, releasing the tension on the spring and allowing the "S" hook to be disengaged from the eye in the floor. By means of this improved device, the two chains at the front of the beds can be taken down in a moment and the beds folded up and pushed against the side of the car, thus leaving the space available for other purposes, if that is desired. These beds are made by the Gosso Company, Chicago.

A HIGHWAY CROSSING ALARM WITH FOUR INDICATIONS

In order to eliminate as far as possible the chances for the warning indication to be overlooked a highway crossing signal has been developed and satisfactorily used on several roads which combines a ringing bell, flashing red

Highway Crossing Signal and Alarm Fitted with the Chicago Electric Flag.

lights and a waving red flag for warning highway traffic, with flashing green lights to indicate to approaching trains that the signal is properly working. The signal shown in the accompanying illustration is mounted on a 4-in. steel pipe equipped with four pressed steel pole steps and a standard crossing sign, the pipe being supported on a combination battery and relay box to accommodate batteries.

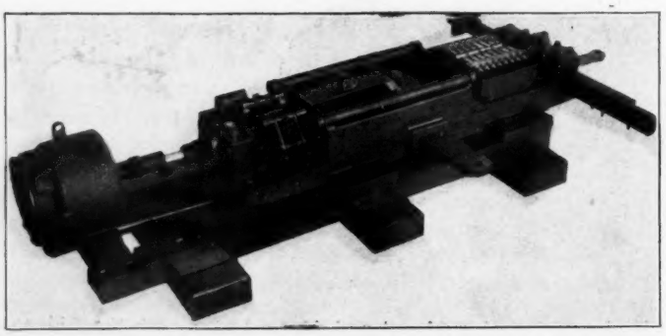
relays, terminals, etc., used in the highway crossing alarm circuit. The electric flag, as the apparatus mounted at the top of the post is called, can also be furnished with bracket mountings which project it 3 ft. or 8 ft. over the highway, these brackets being built up of 3-in. steel pipe.

The bell is 14 in. in diameter at the mouth and made of heavy bell steel, copper plated, or of genuine bell metal or crucible steel, if so specified, and is operated by an electric motor through a set of reduction gears and a cam. No contact trip or springs are used. The flag is 18 in. by 24 in., and is made of heavy sheet steel enameled red, with the word "danger" or "stop" painted in white across both faces in 6-in. block letters. The flag moves up and down through an arc of 45 deg. when the device operates, without jerks or stops. The operation of the flag is also accomplished by reduction gears and a cam from the same motor. The night signal is given by the flashing of two electric lamps at the proper focal points behind two 5⅜-in. red lenses mounted in the case, one on each side facing the highway. The flashes follow each other at evenly timed intervals as the lamp circuit is made and broken at large carbon contact blocks. These blocks are easily removed, and are of such proportions as to carry current up to 10 amperes at any voltage up to 650. Two green lenses are also mounted on the sides of the case visible from approaching trains, and similar flashing signals are given them.

The case which encloses the operating mechanism is water, dust and bug proof and includes an ample space for mounting resistance units, lightning arresters, terminals, etc. The motor is of standard design and can be furnished to operate on any voltage from 10 to 650 direct current, or 110, 220 or 440 volts, alternating current of any cycle. The operating mechanism is mounted on a base within the case, making it easily removable for inspection or repairs. The gears and pinions are bronze against steel, minimizing the friction losses, and the entire mechanism is machined and jig drilled to insure smooth operation, durability and interchangeability. All bearings are provided with easily accessible oilers. This highway crossing alarm is manufactured by the Chicago Railway Signal & Supply Company, Chicago.

A LOW-VOLTAGE SWITCH-OPERATING MECHANISM

The new model 5 low-voltage switch machine of the General Railway Signal Company, Rochester, N. Y., is designed to afford a convenient means of operating outlying switches



G. R. S. Model 5 Low-Voltage Switch Machine, with Cover Removed.

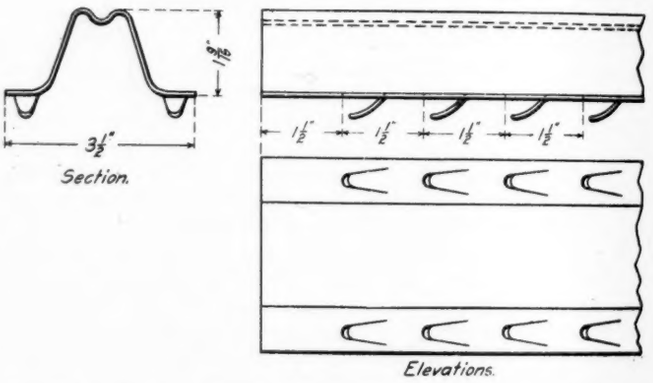
situated, for example, at the entering ends of passing sidings. With the exception of the motor, the switch machine is much the same as the high-voltage type and the a. c. and d. c. designs are an evolution of the model 2 and model 4 switch machines manufactured by this company. The model 5, however, is long, narrow and shallow and is placed parallel to the track where it affords maximum clearance. The machine can be installed in difficult locations and being light in weight, is easily handled. The old model 2 machine was placed at right angles to the track and cannot very well be installed in subways or on elevated structures, etc., where clearance is limited.

This machine, as stated above, permits the operation of outlying switches by power and therefore it eliminates the stopping of heavy trains at passing siding and other switches, which may cost for each stop anywhere from 50 cents to one dollar or more. It eliminates a delay of several minutes in the case of each train entering or leaving the switch, and this facilitates train movements; it serves as an efficient switch lock and insures a stop indication unless the switch points are in the proper position.

The company states that the elimination of one freight train stop per day would more than offset the fixed charges, interest on investment, depreciation and maintenance on an installation comprising switch machine, single-track circuits, and control appliances and accessories.

A GALVANIZED METAL FENCE POST

Steel fence posts with a number of distinctive features are being manufactured by the Metal Post & Culvert Company, Niles, O. The line post consists of a rolled steel shape designed with a view to offering the greatest possible resistance



Cross Section and Part Elevations of the T. & T. Metal Post.

against bending or breaking at the ground line. Numerous small lugs are punched from the two plain surfaces which form the face of the post and bent up to serve as fasteners for the line wires. This construction makes the fastening device a part of the post itself and eliminates the necessity of handling separate pieces or complicated fastenings. Each strand of wire is caught by two of the lugs and the wires when applied serve to strengthen the post by their support.

About five times as many of these steel posts can be placed in a given storage space as wooden posts, the nestable feature of the steel post making it easy to store and to ship. The posts are furnished in lengths ranging from 5 to 12 ft., weighing from 7 lb. to 16.6 lb. They can be driven in ordinary ground, a malleable driving cap being recommended to eliminate any bending of the top of the post. In stony ground a 2-in. auger hole will make it possible to drive the post and such a hole can be driven much cheaper than a 6-in. post hole. In driving the posts it is recommended that they be so placed that the greatest strain will come against the post itself rather than against the fastening lugs, which, however, are designed to have strength enough to withstand any strain ordinarily encountered.

Two types of end and corner posts are made for use with these line posts. One consists of a No. 9 gage seamless cold drawn tubing 4 in. in diameter, galvanized inside and out, set in a concrete base at the end or the corner and reinforced by a brace or braces of tubing anchored to concrete blocks under

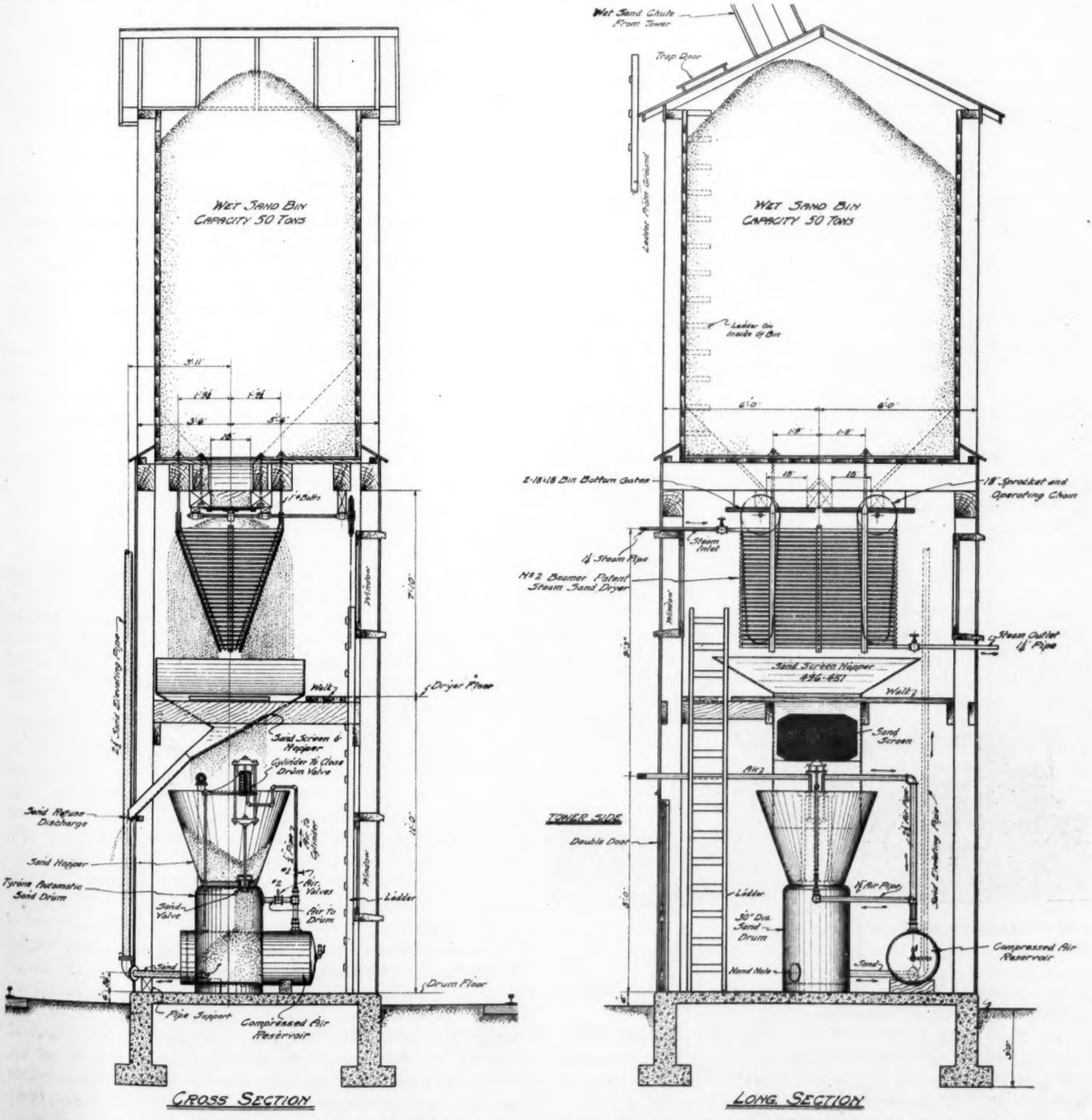
the fence lines. The other type of end and anchor posts consists of an 8-ft. diagonal post through which the line wires are strung and a 5-ft. rod connected to a malleable anchor buried 5 ft. in the ground, the line wires being brought together to fasten to the upper end of the anchor rod at the ground surface.

In addition to the advantages mentioned, this post can be easily painted, as there are no enclosed parts, the fence line can be burned with the remainder of the right of way, the posts serve as electrical grounds in storms, and are said to be free from heaving.

THE "RANDS" GRAVITY SAND PLANT

A new type of plant for handling and drying sand which eliminates sand-shoveling and coal-fired driers has been designed recently and has been installed in connection with locomotive coaling plants at a number of points including Cape Charles, Va., on the New York, Philadelphia & Norfolk; Nashville, Tenn., on the Louisville & Nashville; Trenton, Ont., and Capreol, Ont., on the Canadian Northern, and Henderson, Ky., on the Louisville, Henderson & St. Louis.

This sand plant occupies an area of only 9 ft. by 12 ft., allowing it to be installed between the receiving track and the coaling track of any locomotive coaling station. It can be built of reinforced concrete or frame construction as desired. A car of sand is dumped in the receiving hopper of the coaling plant in the same manner as coal and hoisted in the elevating bucket, from which it is discharged into a chute leading to a 50-ton wet-sand bin in the top of the sand plant. It has been shown that sand can be handled very successfully in this manner, but if the plant is isolated a malleable bucket elevator can be used for handling the green sand. A slide gate at the bottom of the wet-sand bin controls the flow into the "Beamer" patent steam sand drier. This drier is made of 1¼-in. pipe in continuous lengths without joints which are bent to form circular or rectangular receptacles for the sand. The openings are so regulated that the wet



Two Sections of the "Rands" Continuous Sand Drying and Elevating Plant.

sand cannot pass through, but as soon as the sand is dried by the heat of the steam in the pipes it flows through the heater continuously into the hopper of the "Beamer" hand drum below. At the side of this drum is located an air reservoir with two air valves by which the pressure can be applied to the sand in the drum, elevating it to the dry-sand storage bin. A drum full of sand may be elevated in 75 seconds.

The drier is made in the circular shape when a capacity of approximately 7½ tons per 24 hours is desired and for larger capacities 15 tons per 24 hours can be secured by the rectangular shape, which is 8 ft. long and 3 ft. wide. This type of drier has been in service for a number of years on the Pennsylvania, where it has been demonstrated that sand may be dried for about one-seventh the cost for drying it with coal-burning driers, considering the cost of fuel, labor and repairs on the sand stove. The openings between the pipes allow the moisture to escape, thus preventing rusting of the pipes and baking or caking of the wet sand. The action of this drier is continuous and automatic, eliminating the labor required for keeping up fires, removing ashes, feeding the drier and shoveling sand. If steam is not available at the site, the other features of design in the plant may be utilized with coal-burning driers. The Roberts & Schaefer Company, Chicago, is the exclusive licensee of the "Beamer" sand drier, and the designs for the plant described above were prepared by this company.

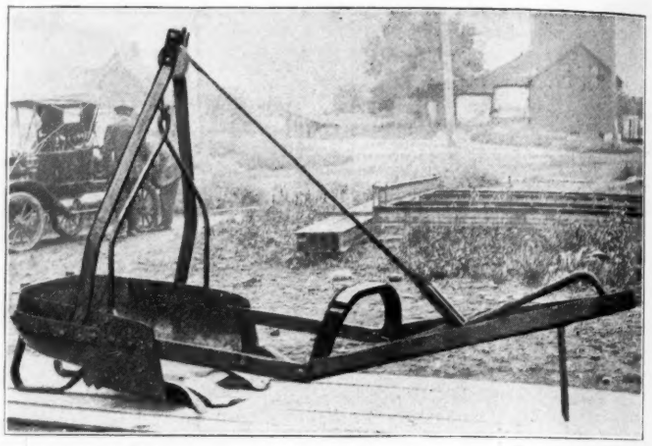
THE ECONOMY LIGHT EXCAVATOR

A light excavator of the drag line type, known as the "Economy," has been in the use on a small scale for two or three years and has demonstrated its adaptability to a wide range of excavating work, such as throwing up small embankments, loading excavated material into wagons, stripping gravel pits and digging and back-filling trenches of all kinds. This machine is equipped with a bucket of

The "Economy" Excavator Handling Material with a ⅝-yd. Bucket.

⅝-yd. capacity, is driven by a gasoline engine, weighs only 12 tons, and is operated by one man.

The main frame work of the excavator is built up of I-beams and in the standard size is 24 ft. square, although these dimensions can be varied if desired. This frame is mounted on four steel wheels 5 ft. high, having a tread 3 ft. wide. The main frame supports a platform 12 ft. by 30 ft., which may be housed if desired, and which supports the operating machinery and all accessories. A rigid steel "A" frame and a 40-ft. boom are mounted on the front of the main frame and the hoisting, swinging and digging lines are arranged to properly connect these members with the engine. The swinging cable is attached directly to the side of the boom, giving a positive and rapid action and eliminating the necessity for a turntable. The excavator is



The Bucket Used with the "Economy" Excavator.

equipped with a 40-hp. gasoline engine of the 4-cycle type, a special carburetor being furnished to permit the use of either gasoline or kerosene for fuel. The amount of gasoline used is stated to vary between 20 and 25 gallons for a 10-hour run under heavy duty. A special scraper and bucket shown in the accompanying illustration is used with this excavator.

It is stated that an operator can swing the loaded bucket from four to six times per minute, and that on the average the machine can handle 500 cu. yds. in a 10-hour shift. During the past summer a contracting firm, Murphy & Engberg, Minneapolis, Minn., handled the material for a 5-ft. fill, with the Economy excavator taking all the dirt from one side. The ground surface was under more than a foot of water during the work, but in spite of this condition the machine handled 1,000 cu. yds. of earth per day. Another machine used for making a large fill behind a bridge on the Chicago & North Western, near Green Bay, Wis., loaded dump wagons at a rate of 500 yds. in a shift. The soil in this case was hard pan mixed with medium sized boulders. Another machine has been used for stripping and cleaning gravel pits on the Chicago & North Western at different points in Iowa throughout the last season, and also for loading gravel cars.

The machine has a number of incidental advantages. Only one operator is required, this man being able to control all movements of the excavator and to see all working parts of the machine from his operating position. The large steel wheels enable the machine to travel over soft ground that would be impossible for any other type. The wheel can be set to make any turn or curve. The machine can be moved ahead by means of a "dead man" or stake without interrupting the use of the bucket or can be moved in the opposite direction with the bucket. The control of the boom enables the operator to pick up the loaded bucket at any point within its radius and swing it to the dump. This eliminates the necessity of dragging the bucket up close to the machine before it is lifted, with a resulting saving in time. The machine complete weighs about 12 tons and is designed to be readily taken down or set up. It can be loaded on one flat car for transportation. This machine is manufactured by the Economy Excavator Company, Iowa Falls, Iowa.